SECOND FIVE-YEAR REVIEW REPORT

For

AIW Frank / Mid-County Mustang Superfund Site

West Whiteland Township

Chester County, PA

March, 2011

PREPARED BY:

U.S. Environmental Protection Agency, Region III
Philadelphia, Pennsylvania

Approved by:

Ronald J. Borsellino, Director
Hazardous Site Clean-up Division

Date:

3/17/2011

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List of Acronyms

AOC	Administrative Order on Consent
CCHD	Chester County Health Department
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cis 1,2 DCE	cis-1,2 dichloroethene
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
ISCO	In-situ Chemical Oxidation
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operations and Maintenance
OU	Operable Unit
PADEP	Pennsylvania Department of Environmental Protection
PADER	Pennsylvania Department of Environmental Resources
PAH	Polycyclic Aromatic Hydrocarbons
PCE	Perchloroethene (also known as Tetrachloroethene)
PCOR	Preliminary Closeout Report
ppb	parts per billion
ppm	parts per million
PRP	Potentially Responsible Party
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
TCA	1,1,1 trichloroethane
TCE	Trichloroethene
ug/L	Microgram per liter
UAO	Unilateral Administrative Order
VOC	Volatile organic compounds

Executive Summary

All portions of the remedy as described in the September 29, 1995 Record of Decision (ROD) for the AIW Frank/Mid-County Mustang Site, West Whiteland Township, Chester County, Pennsylvania have been implemented. The ground water extraction and treatment system is functional, but not currently operating. Since April 2008, the system has not operated in order to allow for a series of three in-situ chemical oxidation (ISCO) pilots in the source area of the plume. At the time the system was shut down, influent contaminant concentrations were below maximum contaminant levels (MCLs). The ISCO pilots have significantly reduced the levels of contaminants in ground water in the most highly contaminated portion of the plume. The estimated TCE mass removed by the three ISCO injections is 4,500 lbs compared to the removal of approximately 71 lbs of TCE from ground water via the extraction and treatment system between November 2000 and April 2008. Since April 2008, no significant negative change in the distribution or contaminant concentration of the dissolved plume has been indicated by the sampling results. The trigger for this five year review was the completion of the first five-year review on March 17, 2006.

The assessment during this five-year review found that the remedy at the Site is protective of human health and the environment in the short term. The most immediate risk of exposure to contaminated ground water has been eliminated by the connection of residents and businesses to the public water supply, which was completed in September 2000. Institutional controls are in place, which currently prevent new residential wells from being installed in the contaminant plume. Contaminated soils, sediments and drums were also excavated and removed in 1998. Clean-up goals are being met in some wells; however, they must still be met throughout the ground water plume.

The remedy is meeting the remedial action objectives as intended by the 1995 ROD. However, EPA and the State will address several issues identified during this five-year review in order for the Site to be protective in the long term. Based on the positive results of the in-situ chemical oxidation pilot injections, a reevaluation of the remedy may be warranted. Also, although vapor intrusion (VI) does not currently appear to be occurring, some additional VI sampling should be conducted. The 1,4 dioxane concentrations in on-site wells have decreased significantly since 2003, however, 1,4 dioxane is still present and should be added as a contaminant of concern through an appropriate decision document. An evaluation should be conducted to determine if arsenic and manganese are background related. The change in MCL for chloroform and arsenic, if it is determined to be Site related, should be addressed as part of any decision document modification.

GPRA Measure Review

As part of this Five-Year Review the Government Performance and Results Act (GPRA) measures have also been reviewed. The GPRA Measures and their current status are provided as follows:

Environmental Indicators

Human Health: HEUC, Human Exposure Under Control.
Ground Water Migration: GMUC, Ground Water Migration Under Control

Sitewide RAU: The Site is Site-Wide Ready for Anticipated Use (SWRAU).

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: AIW Frank/Mid-County Mustang Superfund Site

EPA ID: PAD004351003

Region: 3	**State:** PA	**City/County:** West Whiteland Township/Chester County

SITE STATUS

NPL status: **X** Final □ Deleted □ Other (specify) _____

Remediation status (choose all that apply) □ Under Construction **X** Operating □ Complete

Multiple OUs?* **X** Yes □ No	**Construction Completion date:** 11/08/2000

Has site been put into reuse? **X** Yes □ No

REVIEW STATUS

Lead agency: **X** EPA □ State □ Tribe □ Other Federal Agency _____

Author name: Charlie Root

Author title: Remedial Project Manager	**Author Affiliation:** EPA Region 3

Review period:** October 2010 to March 2011

Date(s) of site inspection: **January 13, 2011**

Type of review:
X Post-SARA □ Pre-SARA □ NPL-Removal only □ Non-NPL Remedial Action Site
□ NPL State/Tribe-lead □ Regional Discretion

Review number: □ first **X** second □ third □ other _____

Triggering action:
□ Actual RA Onsite Construction □ Actual RA Start at OU#3
□ Construction Completion **X** Previous Five-Year Review Report
□ Other (specify) _____

Triggering action date: 03/17/2006

Due Date (five years after triggering action date): 03/17/2011

* "OU" refers to operable unit.

Five-Year Review Summary Form, cont'd

Issues: 1) Evaluate modifying remedy as a result of pilots
2) Reassess potential for future vapor intrusion
3) 1,4 dioxane is present at concentrations of concern
4) Performance standards for chloroform and arsenic
5) Are arsenic and manganese Site related

Recommendations: 1) An evaluation of existing data and pilot study results will be conducted in consultation with PADEP and a remedy change implemented, if appropriate.
2) Conduct additional residential vapor intrusion sampling. **3)** 1,4 dioxane should be added as a contaminant of concern through an appropriate decision document. **4)** Modify remedy to change performance standards for chloroform and arsenic, if it is determined to be site related, to current MCL. **5)** Conduct evaluation of arsenic and manganese relative to background

Protectiveness Statement: The assessment during this five-year review found that the remedy at the Site is protective of human health and the environment in the short term. The most immediate risk of exposure to contaminated ground water has been eliminated by the connection of residents and businesses to the public water supply, which was completed in September 2000. Institutional controls are in place, which currently prevent new residential wells from being installed in the contaminant plume. Contaminated soils, sediments and drums were also excavated and removed in 1998. Clean-up goals are being met in some wells; however, they must still be met throughout the ground water plume.

The remedy is meeting the remedial action objectives as intended by the 1995 ROD. However, EPA and the State will address several issues identified during this five-year review in order for the Site to be protective in the long term. Based on the positive results of the in-situ chemical oxidation pilot injections, a reevaluation of the remedy may be warranted. Also, although vapor intrusion (VI) does not currently appear to be occurring, some additional VI sampling should be conducted. The 1,4 dioxane concentrations in on-site wells have decreased significantly since 2003, however, 1,4 dioxane is still present and should be added as a contaminant of concern through an appropriate decision document. An evaluation should be conducted to determine if arsenic and manganese are background related. The change in MCL for chloroform, and arsenic, if it is determined to be Site related, should be addressed as part of any decision document modification.

Other Comments: N/A

Second Five-Year Review Report
For
AIW Frank/Mid-County Mustang Superfund Site
West Whiteland Township, Pennsylvania

I. Introduction

The purpose of the Five-Year review is to determine whether the remedy at a Site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The United States Environmental Protection Agency (EPA) is preparing this Five-Year Review report pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Section 121(c) of CERCLA states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The Agency interpreted this requirement further in Section 300.430 (f) (4) (ii) of the NCP;

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the second five-year review for the AIW Frank/Mid-County Mustang Site. The triggering action for this statutory review was the date the first five-year review was signed, March 17, 2006. The five-year review is required because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. This review was conducted by the EPA Remedial Project Manager (RPM) for the Site from October 2010 through March 2011.

II. Site Chronology

Table 1: Chronology of Site Events

Date	Event
1982	Volatile Organic Compounds (VOCs) discovered in ground water by the Pennsylvania Department of Environmental Resources (PADER), now known as the Pennsylvania Department of Environmental Protection (PADEP).
1984	CDS Investments owner of the Mid-County Mustang portion of the Site excavates three feet of soil from an area of contamination and disposes of it off site. To prevent future contamination the owner also sealed the floor drains in the manufacturing buildings with cement. All actions were under PADER oversight.
1985	The Tetra Tech NUS multimedia investigation of the site property finds trichloroethene (TCE), tetrachloroethene (PCE), and 1,1,1 trichloroethane (1,1,1 TCA) in ground water and soil
1987	EPA prepares hazard ranking system score
1988	The Site is proposed to National Priorities List (NPL)
October 24, 1989	AIW Frank/Mid-County Mustang Superfund Site is listed on the NPL
1990	Continental Refrigeration Corporation (the owner of the AIW Frank portion of the site) disposes of 30 drums containing mostly methylene chloride under PADER oversight
May 9, 1990	General Notice Letters are issued to Potentially Responsible Parties (PRPs)
August 15, 1991	A fire of unknown origin destroys one of the buildings on the AIW Frank property
April 1995	Remedial Investigation/Feasibility Study (RI/FS) is completed by EPA
September 29, 1995	Record of Decision (ROD) is signed
August 22, 1996	EPA tasked the U.S. Army Corps of Engineers through an Interagency Agreement to prepare the remedial design of Operable Unit 2 (OU2), waterline

December 12, 1997	Administrative Order on Consent (AOC) is signed by Lewis and Ruth Frame (current owners of the AIW Frank portion of the Site) and EPA whereby the Frames would prepare a Remedial Design/Remedial Action work plan for OU3, soil excavation and disposal, drum and sump removal and disposal, structure demolition/restoration, ecological and archeological investigations.
August 5, 1998	A Consent Decree is entered by a federal judge requiring Frames to design and construct the remedial action for OU3.
August 12, 1998	Remedial design begins for OU1, the ground water extraction and treatment system and long-term monitoring.
June 8, 1999	EPA approves the design for the ground water extraction and treatment system
September 4, 1998	EPA approves the Remedial Design/Remedial Action work plan for OU3
October 31, 1998	OU3 on-site construction begins
March 31, 1999	OU3 construction is completed
January 19, 2000	OU1 on-site construction begins
March 29, 2000	OU2 on-site construction begins
September 21, 2000	OU2 construction is completed
November 2, 2000	OU1 construction is completed
November 8, 2000	The Preliminary Closeout Report is signed
Fall-Winter 2004	OU1 Extraction & Treatment System Optimization Evaluation conducted.
March 2005	OU1 Extraction & Treatment System operated with Liquid Phase Carbon Unit treatment only per optimization review suggestions. Significant savings, efficiency, realized while maintaining required treatment performance.
November 2005 through June 2006	Per optimization review and EPA tech support suggestion, In-situ chemical oxidation (ISCO) pilot study implemented in EW-4. EW-4 and EW-5 shut down as part of pilot study.
August 2007 through November 2007	Second ISCO injections occur as part of continuing pilot in EW-4, EW-5 and MW-108A.

September 10, 2007	Ground water treatment system (EW-3 and EW-6) was shut down when permanganate observed in equalization tank.
September 27, 2007	System restarted with only EW-3 in operation.
April 24, 2008	Due to influent concentrations below MCLs and low volume, treatment system was shut down. It remains shut down.
September 2009	Third ISCO injection into OB-1I and EW-4 as part of continuing pilot.
March 2010	Biological remediation pilot study on MW-112B begins with injection of ABC®. ABC® is a patented nutrient source with a buffering agent.

III. Background

Physical Characteristics

The AIW Frank/Mid-County Mustang Superfund Site is located approximately one mile east of Exton on Route 30 in West Whiteland Township, Chester County, Pennsylvania (Figure 1). The Site consists of two adjoining properties in addition to the areal extent of the contaminated ground water plume. The Site also includes areas near or on the two properties where a municipal waterline has been installed and where a ground water treatment facility has been constructed as part of the remedial action. The area of concern on the two properties encompasses approximately 16 acres.

The AIW Frank portion of the Site occupies over 15 acres. All the buildings on the AIW Frank portion of the site have been demolished. The property is currently an open area overgrown with mostly weeds and a large crushed stone/concrete pile remaining from the building demolition. West Valley Creek flows east to west through the northernmost portion of the property, just south of a walking path. Prior to any EPA involvement, the creek was impounded on the property to form a pond measuring approximately 310 feet by 60 feet (0.4 acres). The EPA ground water treatment plant discharges all treated ground water into this pond and from there it flows into West Valley Creek or can be used for spray irrigation of the adjoining County and Township park property.

The Mid-County Mustang portion of the Site (currently Corbo Automotive Services) is less than one acre in size and consists of an auto garage, a parking lot, and a small lawn area. It adjoins the AIW Frank property and a private single family rental residence to the east; the Stauffer Landscaping building to the north; another private duplex rental residence to the west; and a small open field, the old Meridian Bank building, and Route 30 to the south.

There are also two homes located on the property further to the west formerly owned by the Church Farm School. All of these homes have been connected to public

water; however, the two on the former Church Farm School property have been boarded up and no longer serve as residences.

EPA's extraction and treatment system building is on the far northern portion of the Mid County Mustang property behind the existing buildings and near the discharge location to the pond on West Valley Creek (Figure 2).

Land and Resource Use

Land use in the area has been commercial, industrial, and residential. At the time the ROD was written the estimated population residing within one mile of the Site was approximately 916, which included approximately 175 boarding school students. In 1995, approximately 4,680 people resided between one and two miles of the Site. The number of people living in the vicinity of the Site is much higher now as several new residential developments have been built in the area.

Prior to the implementation of EPA's remedial actions, a number of local residences and businesses located over the contaminant plume had private wells that were used as sources of drinking water. In accordance with the remedy described in the1995 ROD, everyone affected by the contaminant plume was placed on public water. The future land use for the Site and surrounding properties is expected to be a mix of open space, commercial and residential.

History of Contamination

The AIW Frank portion of the Site housed a facility that used to manufacture Styrofoam products and commercial refrigeration units. The former production areas were located on the southern half of the property near Route 30. Prior to 1991, there were, two abandoned buildings, two parking areas, associated roadways, and loading docks on this property. Immediately north of the parking area adjacent to Route 30 was a 180 foot by 160 foot one-story building, referred to as the front building, which was used by the AIW Frank Corporation as a manufacturing facility. It is believed that solvents were used to degrease the equipment used to manufacture the Styrofoam products and that the used solvents were at times poured into a floor drain in the front building instead of taking them outside to the used solvent storage tank. Two large storage tanks, one for clean solvents and one for used solvents were located just to the east of the front building. It is believed that mishandling of the solvents in this storage tank area led to the soil contamination found in this area and contributed to the ground water plume.
On August 15, 1991, a fire of unknown origin destroyed the front building. Following the fire, and subsequent demolition of the building remains, the foundation was all that remained of the building. A floor drain in this foundation was discovered following the fire. It is believed to be a potential source of ground water contamination due to its proximity to the areas of highest ground water contamination.

The rear building was originally 200 feet to the north-northeast of the front building, and was used for warehousing and manufacturing while AIW Frank was in

operation. After manufacturing ceased, the rear building was gutted and filled with miscellaneous debris. A number of water and gas lines, formerly used for fire protection and manufacturing, also occupied space in the building. Remedial actions taken under OU3 were completed in 1999 and addressed the issues related to the rear building, some of its contents, an area of contaminated soil, underground storage tanks and a concrete lined drainage ditch and sump. However, the buildings which remained on the AIW Frank portion of the Site have since been torn down and removed and all the concrete building slabs have been torn up and crushed into small stone. A large wind row pile of the crushed stone remains on the property along with EPA's monitoring and extraction wells.

The area of concern on the Mid-County Mustang property was located in the lawn area near the garage. Historical information indicates that previous operators of the auto garage steamed and utilized solvents to clean auto engines. The liquid waste from the engine cleaning operation was then disposed of in floor drains in the garage building. These drains lead to an on-site tile field, which consisted of only a stone filter bed.

Initial Response

Analytical results for ground water and soil samples collected between 1982 and 1984 revealed the presence of various volatile organic compounds (VOCs). The contaminants with the highest observed concentration were trichloroethene (TCE), tetrachloroethene (PCE) and 1,1,1 trichloroethane (1,1,1 TCA). Possibly contaminated wells were fitted with carbon filters to temporarily remove the VOCs from drinking water sources, and a plan to place the affected homes and businesses on public water was written into the 1995 ROD.

As the result of a 1984 investigation conducted by the owners of the Mid-County Mustang property, three feet of solvent-contaminated soil were excavated from the underground stone drainage field. The excavation and off-site disposal were performed under PADER oversight. In addition to the excavation, the floor drains in the garage areas were sealed shut with cement to prevent future issues of a similar nature.

EPA's contractor, Tetra Tech NUS, conducted a multimedia investigation of the property and surrounding industrial sites in 1985 that found elevated levels of TCE, PCE, and 1,1,1 TCA in the soil and ground water. In 1987, EPA prepared a hazard ranking system score for the Site. Subsequently, the Site was proposed for listing on the National Priorities List (NPL) on June 24, 1988, and was officially listed on the NPL on October 24, 1989.

In the fall of 1990, Continental Refrigeration Corporation, the owner, of the AIW Frank portion of the Site, removed and disposed of approximately 30 drums of hazardous substances that they had generated on site. The drums contained mostly methylene chloride and were disposed of under PADER oversight.

The Remedial Investigation and Feasibility Study (RI/FS) conducted by EPA's contractor, Tetra Tech, began in January 1991. The RI/FS was conducted to identify in greater detail the types, quantities and location of contaminants, as well as to develop ways of addressing the contamination. On August 15, 1991, a fire destroyed the front building on the AIW Frank property. To ensure the safety of their employees conducting field work on site, Tetra Tech demolished what remained of the building and disposed of the debris at a demolition waste landfill. Field work for the RI/FS was complete in January 1993.

Basis for Taking Action

Three types of significant contamination were identified at the site:

- Ground water contamination by chlorinated and non-chlorinated VOCs;
- Subsurface soil contamination by various organic compounds including volatile, semivolatile, and pesticide/PCB compounds, and heavy metals;
- Wastes contained in abandoned debris, underground tanks, drums, and a sump.

In order to reduce the risks associated with exposure to site ground water and subsurface soil, the ROD presented performance standards for the following contaminants:

Major Contaminants of Concern in Ground water (ROD 1995)	Performance Standard ug/l, or ppb	Major Contaminants of Concern in Subsurface Soil (ROD 1995)	Performance Standard ug/kg, or ppb
Trichloroethene	5	Trichloroethene	2000
1,1,1-Trichloroethane	200	1,1-Dichloroethene	1000
1,1-Dichloroethene	7	1,1-Dichloroethane	500
1,1-Dichloroethane	81 *	1,1,1-Trichloroethane	1000
1,1,2-Trichloroethane	5	Tetrachloroethene	2000
cis-1,2 Dichloroethene	70		
1,2-Dichloropropane	5		
Tetrachloroethene	5		
Vinyl Chloride	2		
Toluene	1,000		
Chloroform (THM)	100		
Arsenic	50		
Manganese	80*		

* Non-carcinogenic health based concentration

During the RI/FS a risk assessment was performed to determine the level of risk the contaminants on site presented to an individual in various scenarios. Both adult and child resident and non-resident scenarios were investigated during this process. EPA's target risk range for the aggregate lifetime cancer risk is $1x10^{-6}$ to $1x10^{-4}$. If the calculated lifetime cancer risk exceeds $1x10^{-4}$ the contamination is of sufficient concern

to consider remedial action. If the calculated lifetime cancer risk is between $1x10^{-6}$ and $1x10^{-4}$ the need for remedial actions are deemed necessary on a site-specific basis. As discussed in the 1995 ROD, the actual current and future exposures through ingestion, dermal contact and inhalation of vapors during showering with ground water via existing residential wells and on-site monitoring wells exceeded the upper end ($1x\ 10^{-4}$) of EPA's target risk range. The Hazard Index (the total non-carcinogenic affects posed by a contaminant of concern) calculated for the site exceeded EPA's target of one (1) as well, and ground water (ingestion and inhalation) and subsurface soil (child dermal contact) were determined to be the exposure pathways of greatest concern.

IV. Remedial Actions

Remedial Action Objectives

The primary objectives of EPA's remedial actions at the Site as described in the 1995 Record of Decision (ROD) are to: prevent current or future human exposure to contaminants in the ground water, soils and sub-surface soils; to minimize migration of contaminated ground water; to restore ground water to MCLs; to protect uncontaminated ground water and surface water for current and future use, and to protect environmental receptors.

Remedy Selection

On September 29, 1995, EPA signed a ROD documenting the remedial actions for the Site. The necessary remedial actions selected in the 1995 ROD include:

1. Provision of Point-of-Use Carbon Filtration Units (for residents at risk until waterline is extended);

2. Installation of a waterline and service connections;

3. Performance of a Phase I archeological survey prior to any intrusive remedial activities;

4. Excavation and off-site disposal of contaminated soils, following pre-design soil investigations;

5. Removal, decontamination and off-site disposal of drums and sump;

6. Structure Demolition/Restoration;

7. Institutional controls (to prevent the consumption of contaminated ground water and creation of any hydraulically adverse influence on the extraction system operation, including deed restrictions until MCLs are met);

8. Performance of an Additional Ecological Assessment;

9. Extraction and treatment via air stripping of ground water until MCLs are met with vapor phase carbon adsorption and subsequent discharge to either: i) West Valley Creek, ii) the on-site pond, or iii) the West Whiteland spray irrigation publicly owned treatment works (POTW), following a pre-design hydrogeologic investigation;

10. Long-Term Ground Water Monitoring.

Institutional Controls

The September 1995 ROD requires institutional controls to prevent the consumption of contaminated ground water and creation of any hydraulically adverse influence on the extraction system operation, including deed restrictions until MCLs are met. The ROD's prohibitions on wells are currently being met by regulations promulgated and enforced by the Chester County (PA) Health Department (CCHD). These regulations generally prohibit the construction of new wells within the delineated plume area of a contaminated site or within a one-quarter mile area of concern around the boundary of a contaminated plume. See CCHD Rules and Regulations, Section 501.14.2.4 (Ground Water Areas of Concern). This regulation also requires initial sampling of the well water to demonstrate that it meets the drinking water standards before permission from the CCHD is granted to use the new supply well for drinking purposes. EPA has provided CCHD base maps of the Site and supplies Site plume information on a biannual basis to assist them in implementing their regulations in regard to the Site ground water plume. CCHD also contacts EPA prior to approving a new well permit in the vicinity of the Site ground water plume.

Remedy Implementation

EPA divided the remedial design and remedial action of the selected remedy into three individual operable units.

Operable Unit 1 (OU1):
- ground water extraction and treatment system
- long term ground water monitoring

Operable Unit 2 (OU2):
- installation of the public waterline

Operable Unit 3 (OU3):
- soil excavation and disposal
- drum and sump removal and disposal
- structure demolition/restoration
- carbon filters
- ecological assessment
- archeological assessment and institutional controls.

Operable Unit 1

Construction of the extraction and treatment system was completed in November 2000 when the ground water extraction and treatment systems were fully operational. The system consists of a tray aerator designed for 90% VOC removal with vapor phase carbon treatment of the off-gas followed by liquid phase carbon polishing prior to discharge. A site visit was conducted on November 3, 2000, by EPA where it was verified that the system was treating contaminated ground water as designed. Completion of the construction was documented in the preliminary close-out report for the Site dated November 10, 2000. The system was designed to operate 24 hours a day, 7 days per week unattended with autodialing capabilities to notify maintenance personnel if system alarms occur or system components shut down. A spray irrigation discharge system was designed and built as an option for utilizing the water discharged from the treatment system into the on-site pond as a potential irrigation source for the adjoining Township and County park property.

Operable Unit 2

The waterline design and construction were completed in two stages. The first stage consisted of the water main extension while the second stage dealt with the service connections. Philadelphia Suburban Water Company (PSWC), through a contract with USACE, designed and installed the water main extension. The water main extension included 5,483 feet of ductile iron water pipeline, 13 service taps and 4 fire hydrants. The water main extension work was completed in June 2000. Ownership of the extended water supply pipelines was assumed by PSWC. PSWC also accepted responsibility for all future operation and maintenance of the water main extension.

USACE's contractor started construction for the service connection work on June 21, 2000, and completed work on September 21, 2000. This work included the connection of 13 affected or potentially affected homes and businesses to the public water system. It also included either the disconnection of the old supply wells or the conversion of the wells to strictly non-consumptive outside use in compliance with Chester County Health Department regulations. In all cases, the well supply was disconnected from the in-home distribution system. In two instances, residential wells were converted to monitoring wells for annual sampling.

Operable Unit 3

On December 12, 1997, EPA along with Lewis and Ruth Frame, owners of the AIW Frank portion of the Site, signed an Administrative Order on Consent (AOC) whereby the Frames agreed to prepare a Remedial Design/Remedial Action work plan for OU3. On August 5, 1998, the U.S. District Court for the Eastern District of Pennsylvania entered a Consent Decree between EPA and Lewis and Ruth Frame (the Frames) requiring the Frames to perform the remedial action selected in the ROD for OU3 and to pay the United States $1.1 million as reimbursement for the government's response costs

at the Site. On September 4, 1998, EPA in consultation with PADEP, approved the Remedial Design/Remedial Action work plan. The Frame's contractor began work on-site on October 31, 1998. The work included soil excavation in the former above ground storage tank area of the AIW Frank portion of the Site. During excavation, a larger volume of soils were found with elevated levels of TCA than were estimated in the ROD and excavation proceeded to bedrock in some locations if subsurface soil TCA performance standards listed in the ROD were not met. Achievement of subsurface soil TCA clean-up standards was confirmed via soil sample collection and analysis of the bottom and side walls of the excavation prior to backfilling. The contaminated soils were placed in lined roll-off containers and disposed of off-site in accordance with the ROD. Drums which remained in the rear building were over-packed and sent off-site for disposal. A sump containing PCB-contaminated sediment adjacent to the foundation of the front building was excavated of material and then cleaned. The rear building roof was initially reinforced in accordance with township codes, but later the entire rear building was demolished. The OU 3 work also included an ecological assessment regarding a Pennsylvania endangered species and an archeological assessment prior to the soils excavation. No endangered species or archeological artifacts were identified at the Site as a result of these assessments. Completion of this work allows for unrestricted use of the AIW Frank portion of the Site, except for the institutional controls related to the ground water portion of the remedy.

System Operation/Operation and Maintenance

Operable Unit 1

Continuous operation of the ground water extraction and treatment system began on November 8, 2000. Treatment system performance monitoring has been conducted in accordance with the approved Performance Monitoring Plan since system start-up. System influent and effluent were sampled semimonthly and analyzed for specific parameters, as requested by PADEP while the system was in operation through April 2008. Influent and effluent is currently sampled when the treatment system is used to treat sampling purge water during the semi-annual sampling event. Sampling results of the treated water discharge have always been below required discharge limits. Monthly operating reports are submitted to both EPA and PADEP.

Air sampling to monitor off-gas discharges to the atmosphere was conducted quarterly while the vapor-phase treatment of the air-stripper system was in operation. In addition, off-gas monitoring was conducted regularly at various points within the system to determine actual emission control system operation parameters to identify activated carbon usage rates. As discussed in more detail below, use of the tray aerator system was discontinued in 2005 when the system began operating with liquid phase carbon treatment only.

West Whiteland Township assumed all responsibility for the operation and maintenance of the spray irrigation system.

As discussed in more detail below in the "Progress Since Last Five-Year Review" section, beginning in November 2005, the system operation has been altered to allow for a series of three in-situ chemical oxidation (ISCO) pilot studies in the source area of the plume. Since April 2008, the system has been maintained in operational condition, however, the system has been operated only to treat well-purge water from semi-annual sampling.

Prior to the October 2010 sampling event, the treatment system was turned on to confirm that it was in good working condition to treat the purge water generated during the sampling event. Most recently, the extraction and treatment system was found to be operational as intended during the January 13, 2011 site inspection.

In combination with the five-year review site inspection, EPA and PADEP also began discussions regarding PADEP take-over of operation and maintenance in November 2011 in accordance with the Superfund State Contract for the Site. PADEP expressed their understanding of the progress that has been made in achieving the performance standards in the 1995 ROD and their support of the pilot studies. PADEP is aware of their obligation to assume operation and maintenance of the extraction and treatment system, and they have submitted a budget request for funding in the next fiscal year beginning in July 2011. PADEP also expressed their willingness to work cooperatively with EPA should EPA determine that changes in the remedy for the Site are appropriate.

Operable Unit 2

Philadelphia Suburban Water Company (PSWC) accepted responsibility for all future operation and maintenance of the water-main extensions following their completion. Property owners connected to the water-main extension assumed all responsibility for the interior plumbing and water bills following certification of completion of the connections.

Operable Unit 3

The portions of the ROD completed under OU3 included, soil excavation and disposal, drum and sump removal and disposal, structure demolition/restoration, carbon filters, ecological assessment, archeological assessment and institutional controls. These portions of the remedy do not require on-going operation or maintenance.

V. Progress Since Last Five-Year Review

The Protectiveness Statement from the first five-year review for the Site (March 2006) read:

> The Site is protective of human health and the environment in the short term because the most immediate risk of exposure to contaminated ground water has been eliminated by the connection of residents and businesses to the public water supply, which was

completed in September 2000. Institutional controls are in place which will prevent new residential wells from being installed in the contaminant plume. Contaminated soils and drums were also excavated and removed in 1998. For the Site to be fully protective in the long term clean-up goals must be met in ground water. The extraction and treatment system was constructed in accordance with the requirements of the 1995 ROD and has been operating as intended. EPA expects the Site will be fully protective of human health and the environment when the cleanup goals are met.

1,4 dioxane has been identified at the Site in a limited number of wells at relatively low concentrations in the most highly contaminated portion of the plume. EPA will work with PADEP to establish a clean-up standard and effluent discharge criteria for 1,4 dioxane for the Site, as necessary. Vapor intrusion into basements is a potential issue, due to the proximity of two rental residential homes over a portion of the contaminated ground water plume. An evaluation of exiting data to determine if vapor intrusion is a concern at the Site will be conducted and additional steps will be investigated if necessary.

The following discussion summarizes steps taken to address the recommendations relating to vapor intrusion and 1,4 dioxane made in the first five-year review.

Because the in-situ chemical oxidation pilot injections, which are discussed in detail later in this section, showed promise in reducing the contaminant concentrations near the residential properties, sub-slab and indoor air sampling was delayed until the pilots were fully implemented. Based on the EPA Region III technical support personnel's review of the most recent ground water data for the Site, vapor intrusion sampling was conducted in January 2011 at one residential duplex at the Site. Sub-slab and indoor air samples were collected from each side of the duplex as well as an outdoor ambient air sample. Validated analytical results were received on February 8, 2011. An evaluation of the sampling data has determined that while there are levels of TCE of concern in the air beneath the slab on both sides of the duplex, TCE is not present in the indoor air samples. Vapor intrusion does not currently appear to be occurring, but additional VI sampling should be conducted in the future at any potentially affected residence. EPA Region III technical support personnel have suggested sampling later in the next five-year review cycle to allow the remedy to progress further toward achieving clean-up standards prior to re-sampling.

As noted previously, there have not been regular discharges from the extraction and treatment system since April 2008. 1,4 dioxane has been found at the Site in wells in the most highly contaminated portion of the plume. The 1,4 dioxane concentrations in on-site wells has decreased significantly since 2003, however, 1,4 dioxane is still present at concentrations of concern. Based on the reduction seen in 1,4 dioxane as a result of the ISCO pilot injections, it is believed that 1,4 dioxane can be effectively treated in-situ, however, it should be added as a contaminant of concern through an appropriate decision document.

Also, as discussed in the first five-year review, in the Fall of 2004 an Optimization Review of the Site was conducted by EPA Region III and EPA HQ contractor, GeoTrans, Inc. to provide constructive suggestions to improve system performance, minimize costs and shorten the amount of time to reach clean-up goals.

Representatives of PADEP also participated in the optimization review process. The following recommendations and suggestions resulted from the review:

1. EPA and PADEP should work together to develop appropriate discharge and clean-up standards for 1,4 dioxane for the Site.
2. EPA should attempt to reduce system maintenance costs due to tray aerator fouling and carbon unit hardening by testing if the discharge standard can be achieved by utilizing either just the tray aerator, or the carbon units as the treatment method by themselves.
3. EPA should conduct an In-Situ Chemical Oxidation pilot in the relatively small most highly contaminated portion of the plume.
4. EPA should make minor changes to the monitoring reports to improve the report clarity.

As described in recommendation 2. above, in Spring 2005, following a liquid-phase carbon change-out, the treatment system began operating without the tray aerator, relying only on the liquid-phase carbon units for treatment. The change demonstrated positive results. Discharge limits were not exceeded, and no hardening or channelizing due to calcium fouling of the carbon units was noted when the units were changed out after 4 months. The use of liquid carbon only for treatment resulted in a savings of $800.00 in monthly electricity costs and reduction in the time and money required to change out the carbon units. The suggested changes to the monitoring reports were implemented beginning with the May 2005 Semi-Annual Ground Water Monitoring Report.

Also, as suggested by the optimization review, in November 2005, contractors for EPA, conducted an in-situ chemical oxidation (ISCO) treatability study to evaluate the effectiveness of potassium permanganate ($KMnO_4$) in oxidizing VOCs in the most contaminated portion of the Site ground water. The study included injection of 3,000 gallons of 26 g/l $KMnO_4$ solution over two days into EW-4. Initial monitoring during the injections found permanganate in the OB-1I and OB-1S as well as in EW-5 one day after the injection. Locations for EW-4 and EW-5 can be found on Figure 2. Monitoring was conducted in EW-4 and the surrounding wells for a period of 12 weeks following the injection. Extraction wells EW-4 and EW-5 were shut down in November 2005 to perform the ISCO treatability study. These wells have remained inactive since the injection. VOC contaminant levels disappeared initially in wells in close proximity, but have begun to rebound slightly. The concentration of 1,4 dioxane also seemed to decrease due to the injection. The success of the initial pilot and the possibility of expanding the pilot into a full scale application in other wells at the Site led to a second slightly modified ISCO pilot described below.

From August 2007 through November 2007, a second ISCO application was performed targeting the EW-4 area and an area of elevated VOC concentrations surrounding EW-5. This second application of $KMnO_4$ was injected under pressure into

wells EW-4, EW-5, and MW-108A.[1] This process involved injecting high volumes of fluid under pressure into the aquifer. This procedure dilates, or opens, existing bedrock fractures, flushes fine grained material from the fractures, and allows greater volumes of slurry to flow through the fractures.

Monitoring of EW-4 and the surrounding wells was conducted for a period of 11 weeks following the injection process. On September 10, 2007, the ground water treatment system was shut down after $KMnO_4$ was observed in the treatment system equalization tank. On September 27, 2007, the treatment system was restarted using only EW-3. Because of its high yield (90 gals/min.), EW-6 remained off to allow the $KMnO_4$ in the ground water to dissipate. Due to influent TCE concentrations below MCLs, the minimal volume produced from EW-3 and the significant monthly cost to operate the system, the treatment system was shut down on April 24, 2008. The treatment system influent contained only 3 ppb of TCE for several months prior to shut down. The cost to operate the treatment system prior to the shut-down was averaging approximately $21,000 per month. Following the system being turned off the average monthly cost for the Site decreased to approximately $8,000, not including the cost of the subsequent ISCO pilot injection discussed below. The system has remained off since the April 24, 2008 shutdown. No significant adverse change in the distribution or contaminant concentration of the dissolved plume has been indicated by the semiannual sampling results since the system was shut down.

Based on the success of the $KMnO_4$ injections in reducing the VOC concentrations in injection areas, an additional injection was recommended. It was decided that the well with the highest remaining TCE concentrations (OB-1I) would be utilized as an injection point. It was suggested that OB-1I, which is a 2-inch polyvinyl chloride (PVC) well, would not hold up to the high pressures that had been utilized with past injections. To limit the required pressure, the use of a low-pressure pulse injection tool known as the Primawave Sidewinder® was proposed to be piloted. Also, $NaMnO_4$ was proposed as the oxidant because it has a greater solubility than $KMnO_4$ and can be delivered at greater concentrations. Separately, a biological pilot study was proposed for well MW112B, which is located in the mid-gradient portion of the plume where VOC concentrations have only moderately declined since system start up.

Beginning on September 2, 2009, and ending on September 10, 2009, 1,740 gallons of 11 percent $NaMnO_4$ solution was injected into OB-1I. In addition to the injection at OB-1I, 1,260 gallons of $NaMnO_4$ was gravity fed into EW-4 to expedite the completion of injection work.

The ISCO pilots have reduced the levels of contaminants in ground water in the most highly contaminated portion of the plume to non-detectable levels in some wells and near performance standards in others. The estimated TCE mass removed by the three ISCO injections is 4,500 lbs compared to the removal of approximately 71 lbs of TCE

[1] This procedure falls within a broad definition of hydraulic fracturing and was used at this Site to deliver the $KMnO_4$ to the bedrock aquifer. The technique was used under relatively low pressure, injected into vertical wells at relatively shallow depths, and included monitoring.

from ground water via the extraction and treatment system between November 2000 and April 2008. In addition, the annual cost of operation of the extraction and treatment system prior to the ISCO Pilots was approximately $250,000. The current annual cost for the Site is approximately $90,000. The average costs for the ISCO Pilot injections were approximately $100,000 per injection.

Despite the success of the ISCO pilot in the most contaminated portion of the plume, due to the historically lower VOC concentrations and the relative proximity to West Valley Creek and one of its tributaries, EPA determined that bio-stimulation may be more appropriate than ISCO injection in the down-gradient dissolved plume beyond the influence of the ground water extraction and treatment system. ISCO is typically used in higher concentration source area conditions and due to the purple color and chemical characteristics of $KMnO_4$, the possibility of it reaching the creek would be detrimental. In conjunction with the $NaMnO_4$ ISCO injection described above, monitoring well MW-112B was used as an injection point for a small bio-stimulation substrate injection pilot study. The purpose of the pilot was to determine if existing Site ground water conditions, if bio-stimulated, could result in enhanced bioremediation of the VOCs to below performance standards.

Thirty gallons of a substrate solution consisting of 25 gallons of purge water, 5 gallons of ABC® and 30 grams of sodium bromide tracer was injected into MW-112B on March 9, 2010, followed by 30 gallons of unamended ground water**.** ABC® is a patented mixture that contains soluble lactic acid as well as components that slowly release volatile fatty acids over the long-term. The integrated phosphate buffer provides phosphates, which are a micronutrient for bioremediation. In addition, the buffer helps to maintain the pH in a range that is best suited for microbial growth. Samples from MW-112 were collected three, five and seven months after the injection. Samples were analyzed for a combination of VOCs, total manganese, total potassium, bacteria, biomass, *Dehalococcoides* bacteria, metabolic acids, ethanol, dissolved gases, carbon dioxide, TOC, bromide, anions, and alkalinity.

The results of the pilot study were generally positive. However, the inability of MW-112B to accept fluids limited the effectiveness of the injection. Positive results included a 50% reduction in TCE concentration and a fivefold increase in cis 1,2 DCE concentrations, the initial breakdown product. This was accompanied by minor increases in ethene and ethane concentrations, which indicate biodegradation is occurring. Increases in biomass were also observed. Decreases in pH in the injection well during the pilot study to levels detrimental to biologic activity limited the success of the test. Lower pH levels are believed due to the limited ability of the well to transmit water. The limited transmissivity of MW-112 is evidenced by the well purging dry at low pump rates and the lack of change in the sodium bromide tracer concentration during the test. The positive results of the pilot indicate that an expanded evaluation of bio-stimulation utilizing a more aggressive injection method may be warranted.

VI. Five-Year Review Process

Administrative Components

The five-year review for the AIW Frank/Mid-County Mustang Site was conducted by Charlie Root, EPA Remedial Project Manager, with assistance of the PADEP and EPA technical support personnel.

Community Involvement

A notice was published in the Daily Local Newspaper of Chester County on Tuesday, December 28, 2010 announcing that a five-year review was being conducted and that any comments and concerns that anyone in the community may have regarding the Site should be submitted to EPA and that the five-year review was to be completed by March 2011. EPA did not receive any comments in response to this notice.

The notice also announced that the completed Five-Year Review Report will be available to the public at the Site Repository (West Whiteland Township Building) and the EPA Region III Office.

The EPA RPM visited the West Whiteland Township building on January 13, 2011, and met with Mr. Joe Roscioli, Director of Public Works, to determine if the Township had any issues or questions regarding the Site. Mr. Roscioli indicated that he did not have any concerns, but would check with the Township Manager and the Park and Recreation Department and then get back to the RPM, if there were any concerns. No concerns have been identified by the Township to date.

Document Review

This five-year review included the review of a number of relevant documents including:

- September 1995 ROD
- Preliminary Close-out Report (PCOR) November 8, 2000
- Remedial Action Report OU1 March 2001
- Remedial Action Report OU2 March 2000
- Remedial Design/Remedial Action Report OU3 March 24, 1999
- System Start-up Monitoring Report
- Streamlined Optimization Evaluation Report
- Long-Term Monitoring Reports June 2005 – December 2010
- Monthly Operating Reports December 2005 – December 2010

Data Review

As discussed above, the extraction and treatment system was not in operation during the entire five-year review period. The treatment system was shut down on April 24, 2008, due to low influent VOC concentrations and volume. Since April 2008, no

significant negative change in the overall distribution or contaminant concentration of the dissolved plume has been indicated by the bi-annual sampling results.

Extraction Wells

In summary, current TCE concentrations in the extraction wells are significantly less than their pre-system start-up values. Only EW-5 had a concentration above the ROD cleanup standard for TCE (Figure 3).

Source Area Wells

TCE concentrations in wells in the vicinity of the former AIW Frank building are significantly lower than their pre-system start-up levels (Figure 4).

In MW-116, the TCE concentration decreased in the first year of treatment system operation from a pre-system start-up level of 384 µg/L to 1.6 J µg/L. Since then, the concentration has varied between 0.3 J µg/L (May 2005) and 13 L µg/L (April 2003). The TCE concentration observed in this well during the October 2010 sampling event was 5.2 µg/L.

In OB-1S, the TCE concentration has been steadily decreasing from the pre-start-up level of 39 µg/L, and has been less than the cleanup criterion of 5 µg/L since November 2004. OB-1S is co-located with OB-1I, which received a $NaMnO_4$ injection in September 2009. Residual $NaMnO_4$ was seen during the October 2009 sampling of OB-1S, which indicates that this well was also influenced by the injection. TCE was not detected during the October 2009 and April 2010 sampling events. The TCE concentration observed in this well during the October 2010 sampling event was 1 µg/L.

Historically, the highest TCE concentrations have been seen in the intermediate and deep wells, including a TCE concentration of 210 µg/l in MW-111 in May 2005. At well MW-111, the TCE concentration decreased to nondetect (ND) in February 2008, after the August 2007 $KMnO_4$ injection. The TCE concentration rebounded to a high of 26 µg/L in October 2008. TCE was not detected in MW-111 during the October 2009 sampling event, suggesting that the September 2009 $NaMnO_4$ injection influenced this well. Since October 2009, TCE increased to the present concentration of 11 µg/L, suggesting that some rebound has occurred.

The TCE concentration in OB-1I showed a different trend following the August 2007 $KMnO_4$ injection as compared to the trend displayed after the November 2005 $KMnO_4$ injection. After the 2005 injection, the TCE concentration decreased from 470 µg/L in October 2005 to 98 µg/L in May 2006. The concentration then rebounded to 640+ µg/L. After the 2007 injection, the TCE concentration increased to 760 µg/L in March 2008, and to 1,200 µg/L in June 2008. This type of rebound is commonly seen in source areas due to the desorbtion of contaminant from the surrounding rock matrix. It should be noted that the OB-1I well cluster was constructed in a historic Site well believed to be used for disposal. In September 2009, well OB-1I was directly treated

with oxidant for the first time. Rebound has not been seen in the well as TCE has not been detected since the September 2009 injections. Future sampling events will continue to evaluate the long-term effectiveness of the ISCO treatment in this well.

The TCE concentration in the deep well MW-108A decreased from 180+ µg/L in May 2007 to 4.8 µg/L in June 2008 (after the August 2007 $KMnO_4$ injection). The concentration increased to 23 µg/L in October 2008, and a similar concentration was observed in April 2009 (20 µg/L). TCE was not detected during the October 2009 sampling event, indicating that the September 2009 injections in OB-1I and EW-4 influenced the concentrations in this well. Since October 2009, TCE increased to the present concentration of 50+ L µg/L, suggesting that rebound has occurred.

Mid-Gradient Wells

The TCE data have shown an overall decline relative to pre-start-up conditions in the mid-gradient segment of the plume, near the Mid-County Mustang source and in the more highly fractured and higher yielding portion of the carbonate aquifer (Figure 5).

In shallow well OB-3S, the pre-start-up TCE concentration was 150 J µg/L. TCE concentrations in this well have fluctuated, however, they have decreased overall since the pre-start-up sampling. The October 2010 TCE concentration was 49+ µg/L. The maximum TCE concentration in shallow well OB-5 was 160 µg/L in April 2003. The first ISCO injection resulted in an initial decrease in the TCE concentration followed by contaminant rebound. The rebound appeared to stop prior to the second ISCO injection, as TCE concentrations decreased between October 2006 and May 2007. This downward trend continued through the second ISCO injection. In April 2009, the TCE concentration of 2.2 µg/L was an historical low for this well. The TCE concentration remained less than the cleanup criterion in October 2009. By the April 2010 sampling event, the TCE concentration had increased to 11 µg/L. The TCE concentration during the current reporting period is 4.3 µg/L, which is below the cleanup criterion of 5 µg/L.

In deep well OB-4, the pre-start-up TCE concentration was 26 µg/L. The TCE concentration has been less than 10 µg/L since 2002 and below the cleanup criterion since February 2008. The TCE concentration during the October 2010 sampling event was 1.7 µg/L.

Down-Gradient Wells

In the down-gradient segment of the plume, beyond the extraction well network, the TCE concentrations are lower when compared to their pre-system start-up levels. However, the aerial extent of contaminants has remained consistent (Figure 6).

In shallow well MW-114, the TCE concentration generally declined from 160 J µg/L in July 2001 to 25 µg/L in November 2004. Since November 2004 TCE concentrations have ranged from a high of 58 µg/L in June 2008 to a low of 20 µg/L in April 2009. Most recently the concentration of TCE was 48+ µg/L in October 2010.

In deep well MW-112B, the TCE concentration has fluctuated between a high of 190 µg/L (October 2003) and a low of 57 µg/L (April 2009). As discussed above, a substrate injection was conducted at MW-112B in March 2010. The TCE concentration dropped to 16 µg/L in the sample collected the day after the injection. The October 2010 concentration was 45 µg/L suggesting that rebound has occurred.

The TCE concentrations in intermediate well MW-115 and deep well MW-113B were recently less than the performance standard of 5 µg/L. The October 2010 TCE concentrations were 3 µg/L and 4 µg/L, respectively.

Far Down-Gradient Wells

Wells MW-105A and MW-105B are located in the far down-gradient portion of the plume. The TCE concentration in deep well MW-105B has varied between 2.8 µg/L and 17 µg/L. The October 2010 sampling event TCE concentration was 7.9 µg/L. The intermediate well MW-105A has shown a generally decreasing trend in TCE concentration since start-up. The October 2010 sampling event TCE concentration was 3.4 µg/L.

Residential wells HW-06 and HW-13A which remained open as part of the long-term monitoring program have continued to exhibit TCE concentrations below the cleanup criterion of 5 µg/L. TCE was detected at 3.3 µg/L in residential well HW-13B during the October 2010 sampling event. TCE concentrations at well HW-13B have fluctuated between 2.3 µg/L and 5.8 µg/L since October 2002 (Figure 7).

Additional far down-gradient residential wells that were reconfigured and plumbed to remain open for non-potable outdoor use after the properties were connected to the waterline were sampled as part of the April 2010 sampling event. These wells were allowed to remain open for non-potable outdoor use under Chester County Health Department regulations, only after the property owner's petition to the CCHD was reviewed and approved in consultation with EPA. No contaminants were detected in the samples collected from these wells in April 2010.

1,4 Dioxane

Samples have been analyzed for 1,4-dioxane since the October 2003 semi-annual sampling event. In the initial sampling event, 1,4-dioxane was detected in 23 wells. The highest concentrations were found in wells EW-4 (250 L µg/L), MW-108A (250 µg/L), and OB-1I (160 µg/L). For subsequent sampling events, the concentration of 1,4-dioxane showed a decreasing trend in most wells. Most recently, in the October 2010 sampling event, 1,4-dioxane was detected in 25 of 30 wells sampled. However, the highest concentrations during the October 2010 sampling event were detected in EW-4 (13 µg/L), MW-108A (11 µg/L), and MW-114 (7 µg/L). The concentration of 1,4 dioxane has decreased by an order of magnitude overall since 2003 (Figure 8, Figure 9, Figure 10).

Other Contaminants of Concern

As for other contaminants of concern, the concentration of 1,1 DCE decreased below the performance standard (7µg/L) in all extraction wells in October 2008 and has remained below since (Figure 11). 1,1 DCE also decreased below 7µg/L in source area wells following the most recent ICSO injection into OB-1I and has remained below since that time (Figure 12). Cis-1,2 dichloroethene historically remained above its performance standard (70 µg/L) only in monitoring well OB-1I, but decreased below the standard following the most recent ISCO injection and has remained below (Figure 13). 1,2 dichloropropane has been found above its performance standard (5 µg/L) only in well OB-3S. The concentration of 1,2 dichloropropane has decreased since the first five-year review, however, it remains above 5 µg/L in this well (Figure 14). The performance standard listed in the 1995 ROD has not been exceeded for any other contaminant of concern in any Site wells other than those discussed above since the first five-year review.

Overall TCE concentrations as well as other contaminants of concern have continued to decrease since the first five-year review, however, the aerial extent and orientation of the plume have remained relatively steady (Figure 15, Figure 16).

Site Inspection

The site inspection was conducted on January 13, 2011, by Charlie Root of EPA, David Ewald of PADEP, Jonathan Rihs and Nathan Doyle of HydroGeologic (HGL), the EPA contractor tasked to operate and maintain the extraction and treatment system and conduct the required sampling at the Site. The extraction and treatment system was operational as intended by the design during the inspection. A minor punch list of routine O&M items was generated. These items will be addressed in the next few months as weather conditions allow. The extraction wells, EW-2, EW-3, EW-4, EW-5 and EW-6, were inspected and were in good condition. Minor repairs to the well vaults needing attention were noted and will be completed in the Spring. The physical condition of the Mid-County Mustang portion of the Site has remained essentially unchanged since construction was completed. The large wind row pile of crushed stone as reported in the previous five-year review remains on the AIW Frank portion of the Site. The monitoring wells are secured and in good condition.

Interviews

The US EPA project manager contacted the West Whiteland Township engineer on January 13, 2011 to notify the Township of the Second Five-year Review, relay Site progress and discuss any concerns the Township may have with the EPA remedy at the AIW Frank/Mid-County Mustang Site. The Township engineer did not voice any concerns regarding the Site. Also, routine contact has been maintained with the Site property owners regarding sampling access and for routine site status updates.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Yes, the assessment of this second five-year review found that the remedies were constructed in accordance with the 1995 ROD and function as intended. Although the extraction and treatment system (OU1) has not been operating since April 2008 to allow for ISCO pilot studies, contaminant levels in on-site wells have decreased overall since 2005 and decreased significantly in source area wells as a result of the ISCO injections. TCE levels in the most contaminated portion of the plume have been reduced in some wells to levels below the clean-up standards in the 1995 ROD. Based on the most recent site inspection the extraction and treatment system is functional as intended by the 1995 ROD. However, a decision to proceed with an alternative remedial approach, such as in-situ injections and monitoring, or reestablishment/reconfiguration of the extraction and treatment system needs to be made and documented in an appropriate decision document. The immediate threats have been addressed and the remedies are protective. Exposure to contaminated ground water has been eliminated by the connection of residents and businesses to the public water supply (OU2), which was completed in September 2000. Institutional controls are in place that currently prevent new residential wells from being installed in the contaminant plume. Soil excavation and disposal, drum and sump removal and disposal, structure demolition/restoration, ecological assessment, and an archeological assessment (OU3) were completed in March 1999 and met the objectives of the 1995 ROD for that portion of the remedy.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Since the 1995 ROD, there have been numerous changes in exposure assumptions and toxicity data, however, these changes do not result in changes to the original remedial action objectives, the risk decisions made for the Site or the protectiveness of the remedies selected and implemented. There have been significant changes in EPA's risk assessment guidance since 1995. These include changes in dermal guidance, inhalation methodologies, exposure factors, and a change in the way early-life exposure is assessed for vinyl chloride. Also regarding changes in toxicity values, some have increased while others have decreased, making it impossible to generalize about whether the risks would be higher or lower if recalculated today. Specifically relating to the performance standards for this Site there have been changes in MCLs for arsenic (MCL now 10 ug/L, not 50 ug/L) and chloroform (MCL now 80 ug/L, not 100 ug/L), and additionally, the Regional Screening Level (RSL) for 1,1-dichloroethane has changed to 2.4 ug/L (based on cancer risk of 1E-06) now, and the RSL for manganese is now 880 ug/L based on an HI=1. While listed as contaminants of concern in the 1995 ROD, there is no historic evidence of releases of arsenic or manganese at the Site. An evaluation of arsenic and manganese relative to background may be appropriate.

Current risk assessment guidance and toxicity values may change again in the coming years, and protectiveness is best assessed at the time when it is believed that ground water cleanup has been achieved. Therefore, it is recommended that the ground water be evaluated at the end of the remedy to ensure protectiveness at that time.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new information has come to light which questions the protectiveness of the remedy selected in the 1995 ROD. 1,4 dioxane is present in ground water at the Site at levels of concern. However, the concentration of 1,4 dioxane has decreased by an order of magnitude overall since 2003 when sampling for the compound began. While still present, based on the reduction seen in 1,4 dioxane as a result of the ISCO pilot injections, it is believed that 1,4 dioxane can be effectively treated. However, 1,4 dioxane should be added as a contaminant of concern through an appropriate decision document. There has been changes in the MCLs for chloroform (MCL now 80 ug/L, not 100 ug/L) and arsenic (MCL now 10 ug/L, not 50 ug/L), which should be addressed as part of any decision document modification. An evaluation of arsenic and manganese relative to background may be appropriate. The possibility of vapor intrusion as a pathway for contaminants to enter residential properties was identified in the first five-year review. Based on the EPA Region III technical support personnel's review of the most recent ground water data for the Site, vapor intrusion sampling was conducted in January 2011 at one residential duplex at the Site. Sub-slab and indoor air samples were collected from each side of the duplex. An evaluation of the sampling data has determined that while there are levels of TCE in the air beneath the slab on both sides of the duplex, TCE is not present in the indoor air samples. Vapor intrusion does not currently appear to be occurring, but future sampling should be conducted at potentially affected residences.

Technical Assessment Summary

According to the data, monitoring reports and operating reports, and the site inspection, the remedy is meeting the remedial action objectives as intended by the 1995 ROD. However, based on the positive results of a series of in-situ chemical oxidation pilot injections, a reevaluation of the remedy may be warranted. Also, vapor intrusion does not currently appear to be occurring, but an additional round of VI sampling should be conducted. The 1,4 dioxane concentrations in on-site wells have decreased significantly since 2003, however, 1,4 dioxane is still present. Based on the reduction seen in 1,4 dioxane as a result of the ISCO pilot injections, it is believed that 1,4 dioxane can be effectively treated. However, 1,4 dioxane should be added as a contaminant of concern through an appropriate decision document. An evaluation of arsenic and manganese relative to background may be appropriate. The change in MCL for chloroform should be addressed as part of the any decision document modification.

VII. Issues

Table 2: Issues

Issues		Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
#1	Evaluate modifying remedy as a result of pilots	N	N
#2	Reassess future vapor intrusion	N	Y
#3	Add 1,4 dioxane as contaminant of concern	N	Y
#4	Performance standard for chloroform and arsenic	N	Y
#5	Are Arsenic and Manganese Site related	N	Y

IX. Recommendations and Follow-Up Actions

Table 3: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1)Evaluate modifying remedy as a result of pilots	An evaluation of exiting data and pilot study results will be conducted in consultation with PADEP and a remedy change implemented, if appropriate.	**EPA**	**PADEP**	**06/30/2012**	**N**	**N**
2) Reassess future vapor intrusion	Conduct additional residential vapor intrusion sampling.	**EPA**	**PADEP**	**06/30/2015**	**N**	**Y**
3) Add 1,4 dioxane as contaminant of concern	Modify remedy to add 1,4 dioxane as contaminant of concern.	**EPA**	**PADEP**	**06/30/2012**	**N**	**Y**
4)Performance standard for chloroform and arsenic	Modify remedy to change performance standards for chloroform, and arsenic if it is determined to be site related, to current MCL.	**EPA**	**PADEP**	**06/30/2012**	**N**	**Y**
5)Are arsenic and manganese Site related	Conduct evaluation of arsenic and manganese relative to background	**EPA**	**PADEP**	**06/30/2012**	**N**	**Y**

X. Protectiveness Statement

The assessment during this five-year review found that the remedy at the Site is protective of human health and the environment in the short term. The most immediate risk of exposure to contaminated ground water has been eliminated by the connection of residents and businesses to the public water supply, which was completed in September 2000. Institutional controls are in place, which currently prevent new residential wells from being installed in the contaminant plume. Contaminated soils, sediments and drums were also excavated and removed in 1998. Clean-up goals are being met in some wells; however, they must still be met throughout the ground water plume.

The remedy is meeting the remedial action objectives as intended by the 1995 ROD. However, EPA and the State will address several issues identified during this five-year review in order for the Site to be protective in the long term. Based on the positive results of the in-situ chemical oxidation pilot injections, a reevaluation of the remedy may be warranted. Also, although vapor intrusion (VI) does not currently appear to be occurring, some additional VI sampling should be conducted. The 1,4 dioxane concentrations in on-site wells have decreased significantly since 2003, however, 1,4 dioxane is still present and it should be added as a contaminant of concern through an appropriate decision document. An evaluation should be conducted to determine if arsenic and manganese are background related. The change in MCL for chloroform and arsenic, if it is determined to be Site related, should be addressed as part of any decision document modification.

XI. Next Review

The next five-year review for the AIW Frank/Mid-County Mustang Site is to be completed within five years from the completion of this review.

Attachments

X:/EPA010/AIW_Frank/Maps/
Oct_09_semiannual_GW_Monitoring/
gen_loc.mxd
12/18/09

HGL
HydroGeoLogic, Inc

Legend

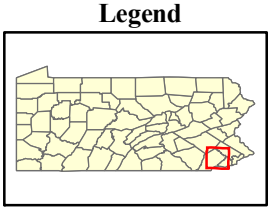


Figure 1
AIW Frank/
Mid-County Mustang Site
Location Map

X:/EPA010/AIW_Frank/Maps/
Oct_10_semiannual_GW_Monitoring/
Site_Layout_Aerial.mxd
Source: HydroGeoLogic, Inc.
12/17/10 CNL

HGL HydroGeoLogic, Inc

Legend

- Shallow Well
- Intermediate Well
- Deep Well
- Extraction Well
- Residential Well

N

0 120 240 480
SCALE IN FEET

Figure 2
Site Layout
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania

Figure 3

TCE CONCENTRATION TRENDS
EXTRACTION WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

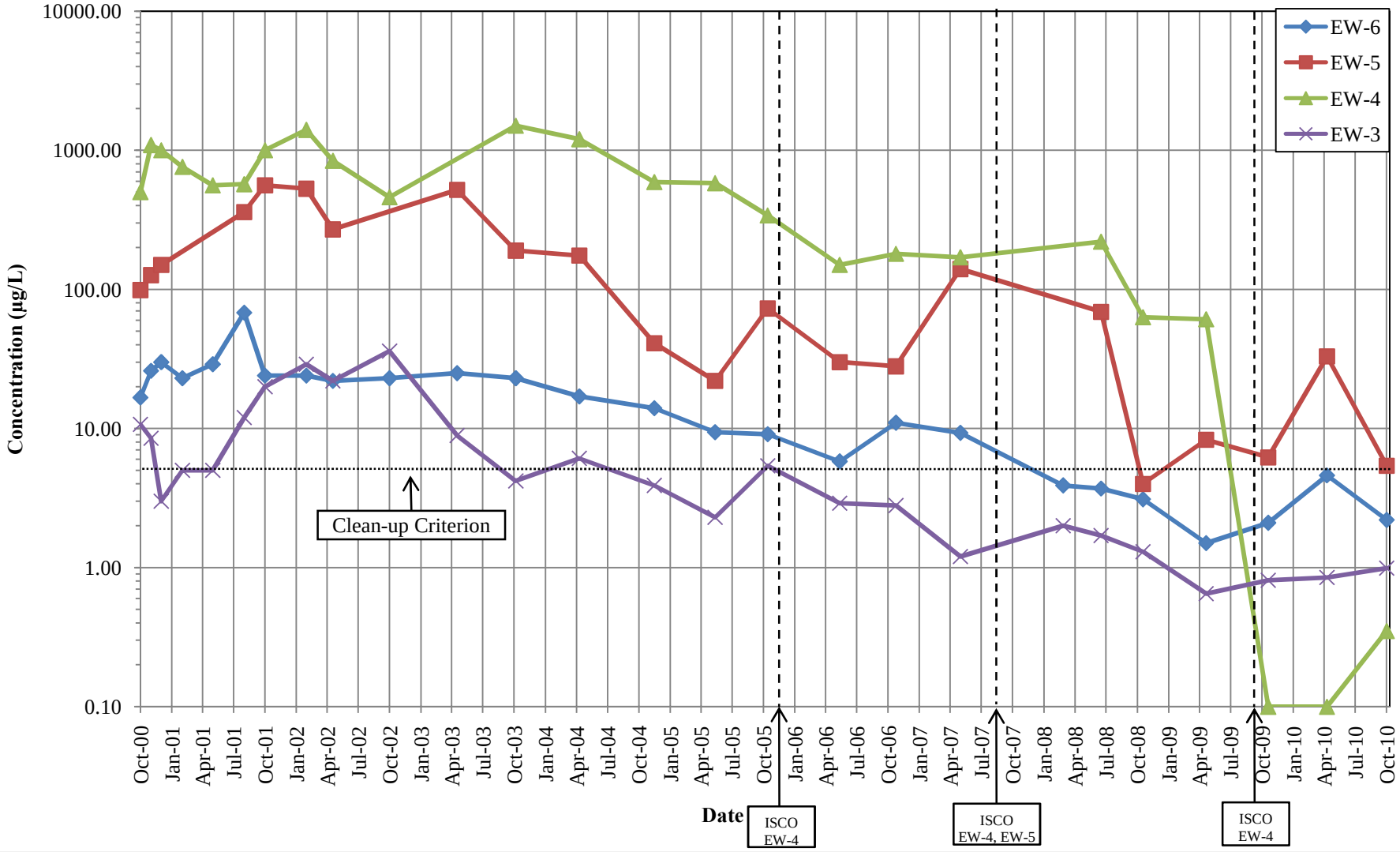


Figure 4

TCE CONCENTRATION TRENDS
SOURCE AREA WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

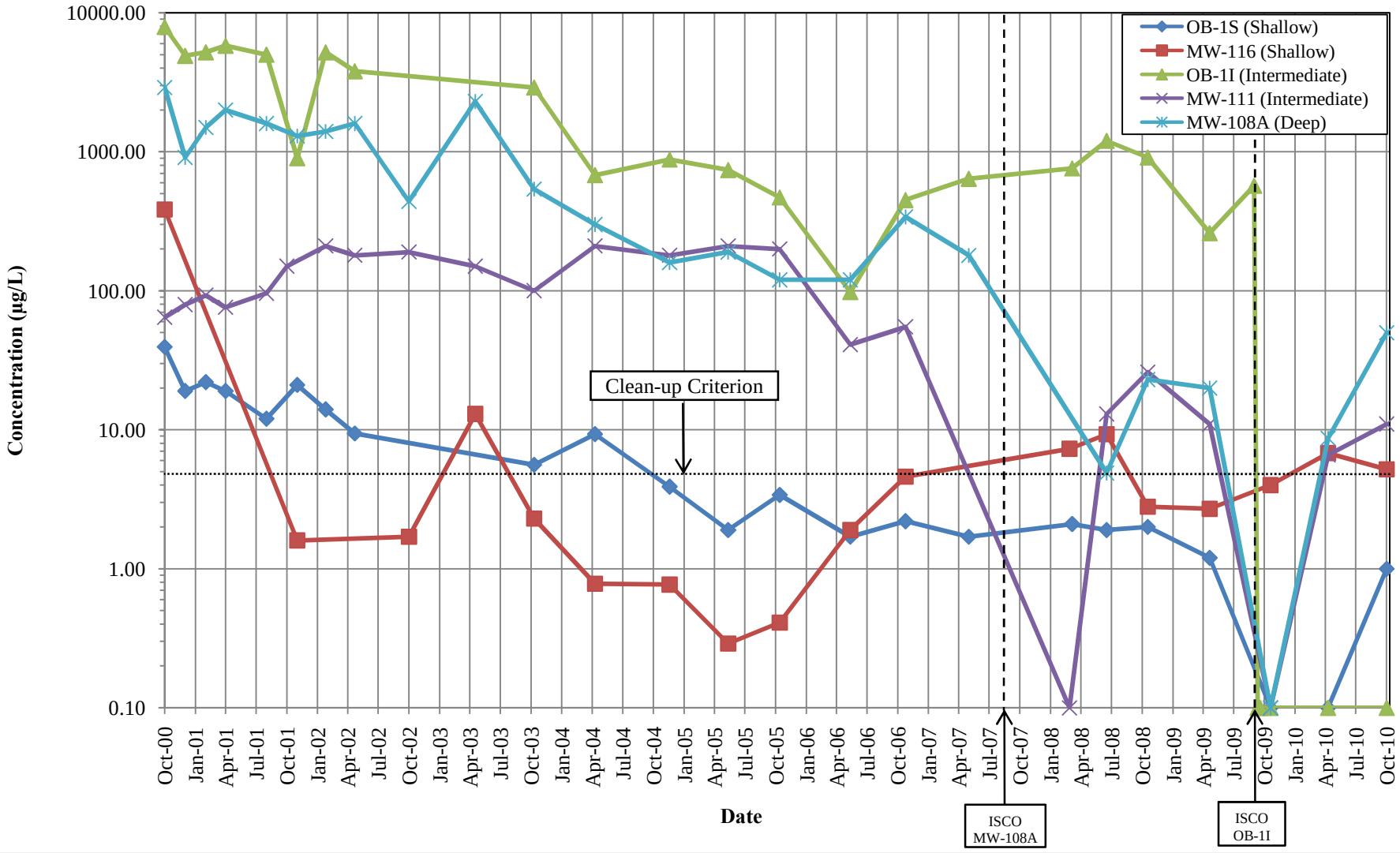


Figure 5

TCE CONCENTRATION TRENDS
MID-GRADIENT WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

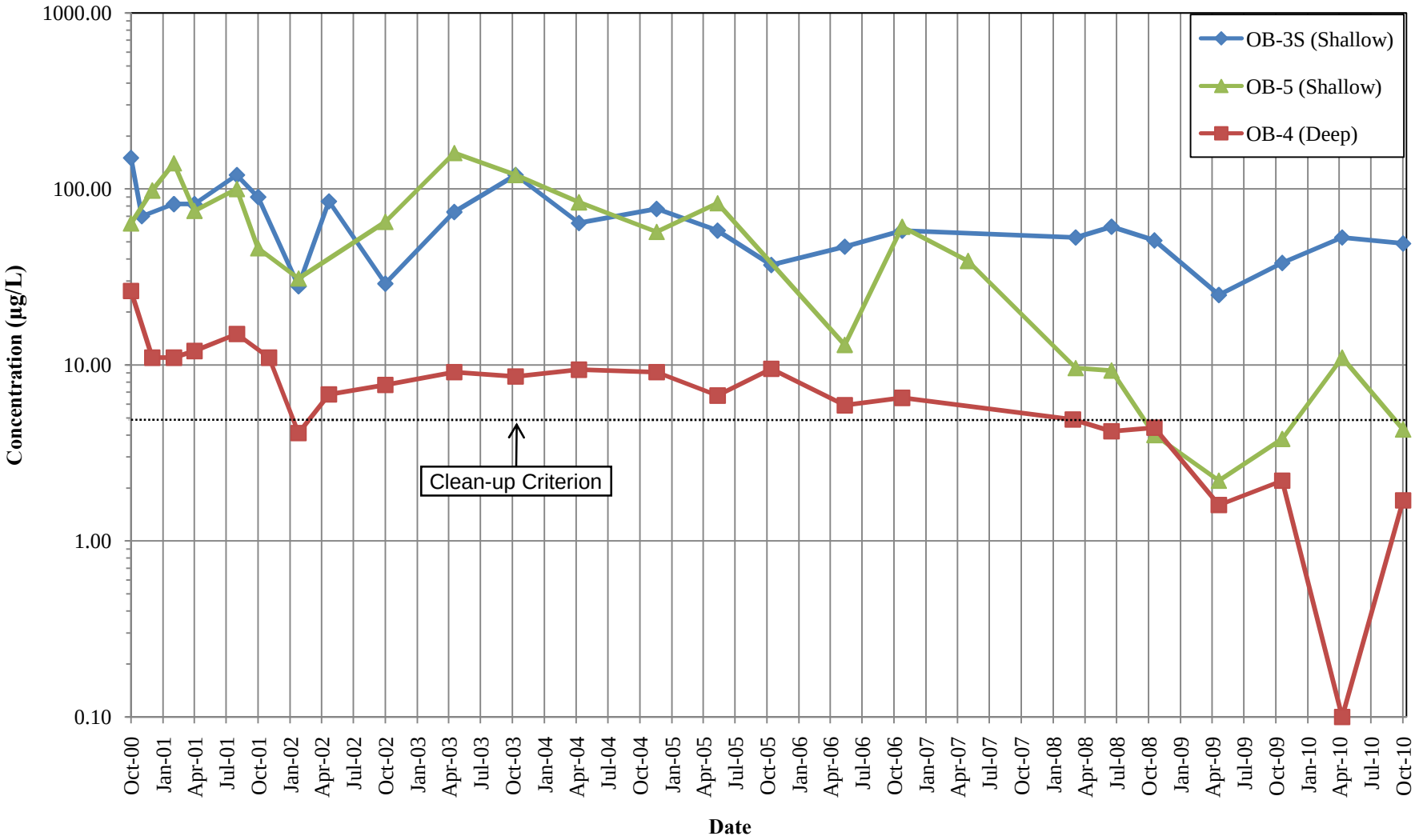


Figure 6

TCE CONCENTRATION TRENDS
DOWN-GRADIENT WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

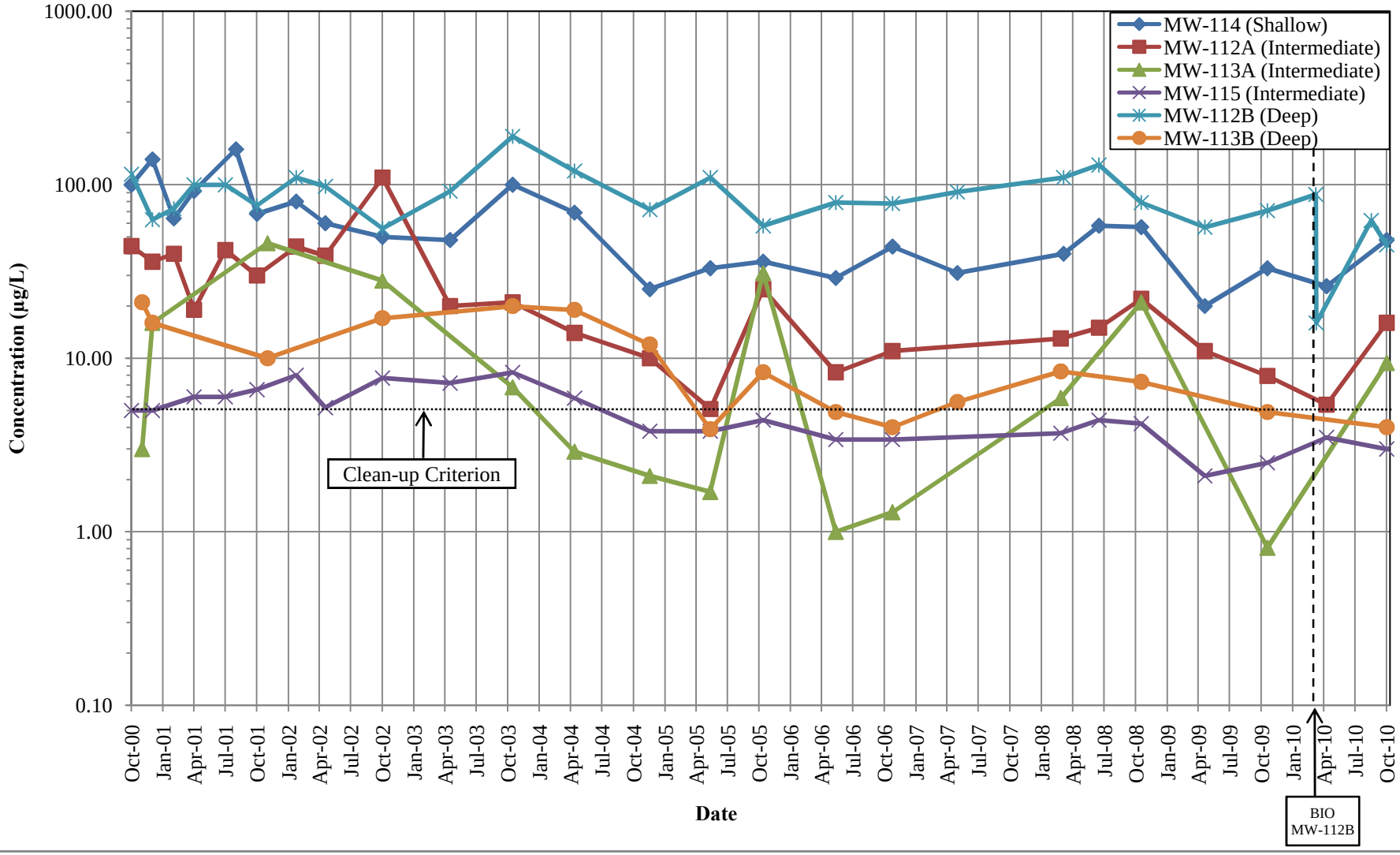


Figure 7

TCE CONCENTRATION TRENDS
FAR DOWN-GRADIENT WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

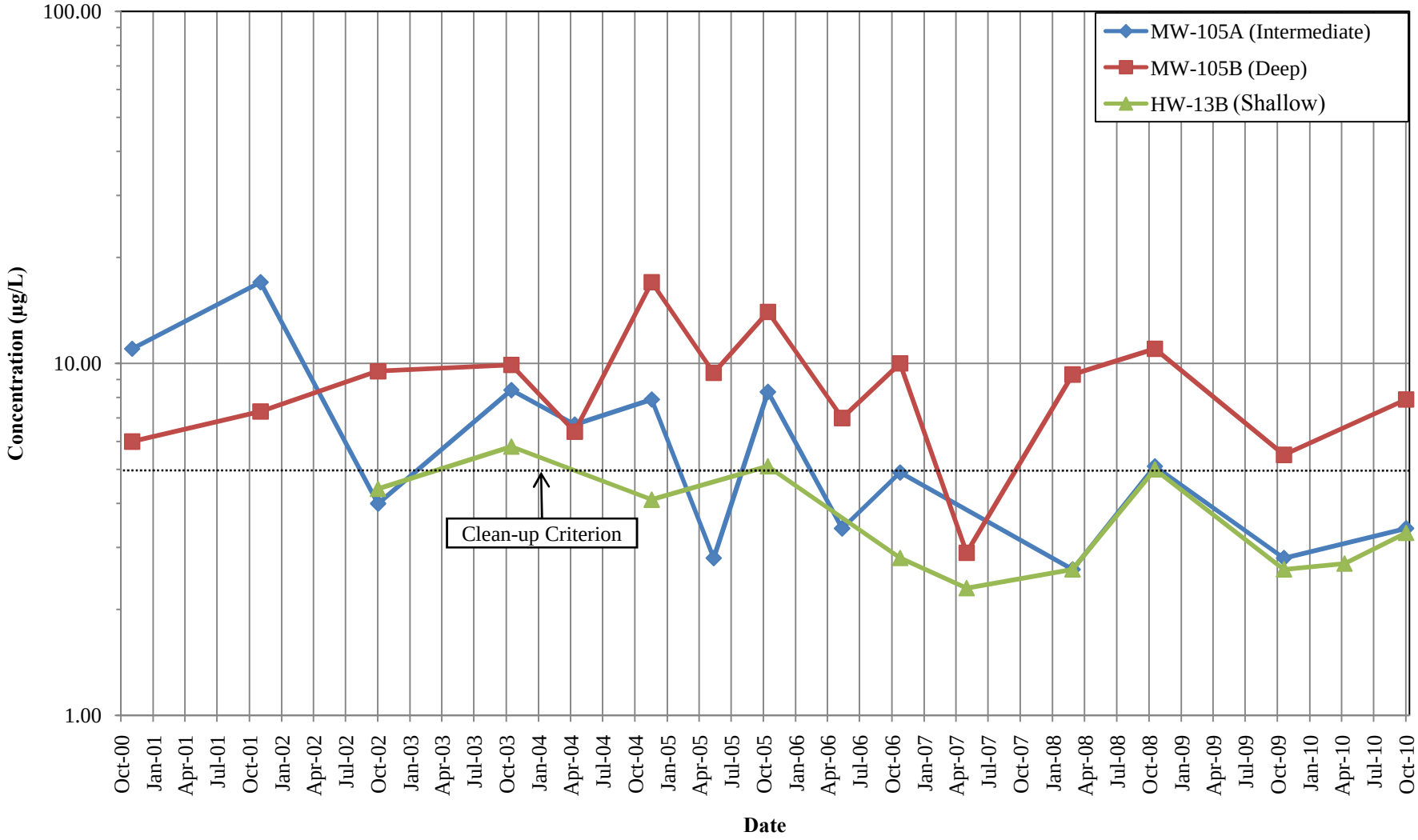


Figure 8

1,4-DIOXANE CONCENTRATION TRENDS
EXTRACTION WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

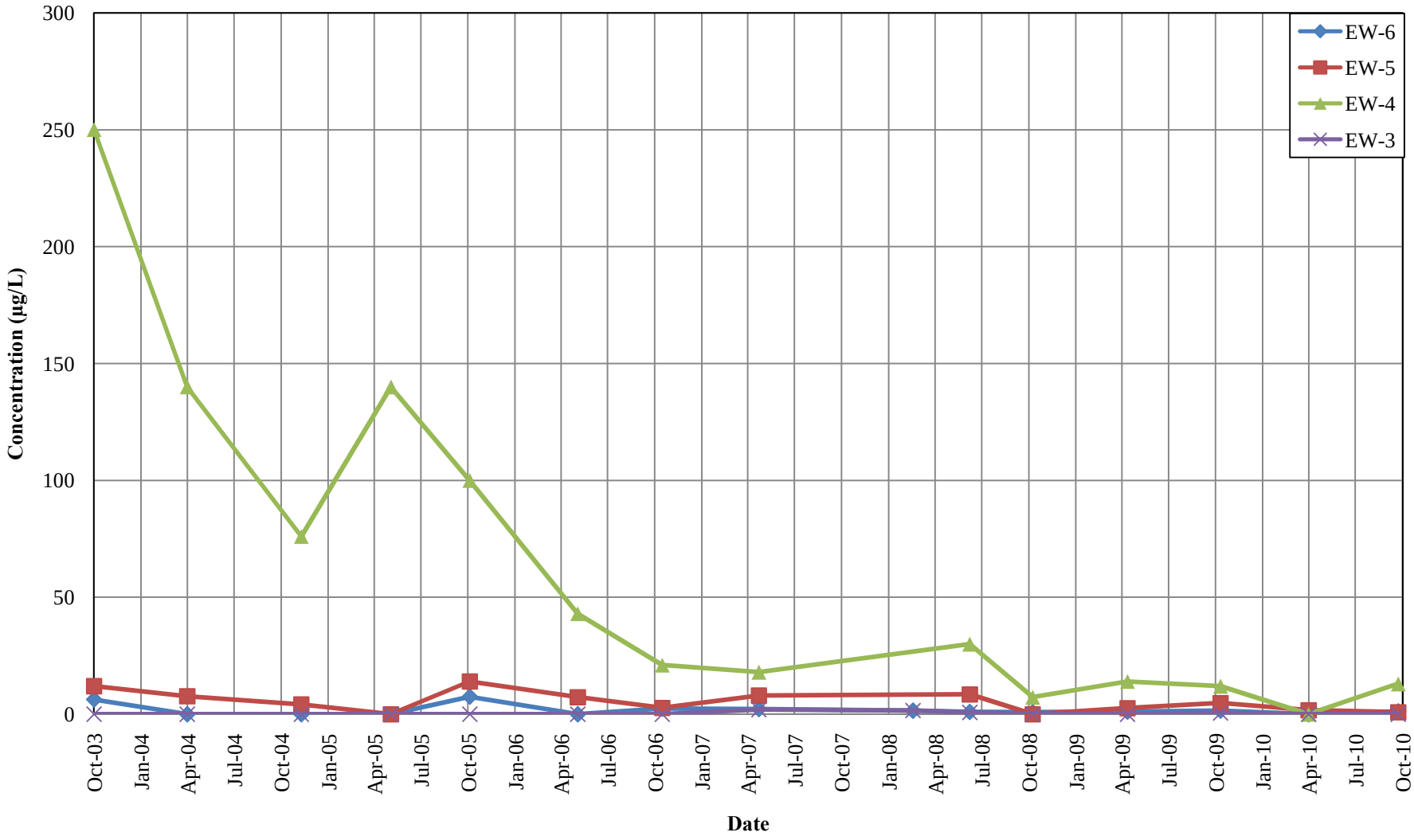


Figure 9

1,4-DIOXANE CONCENTRATION TRENDS
SOURCE AREA WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

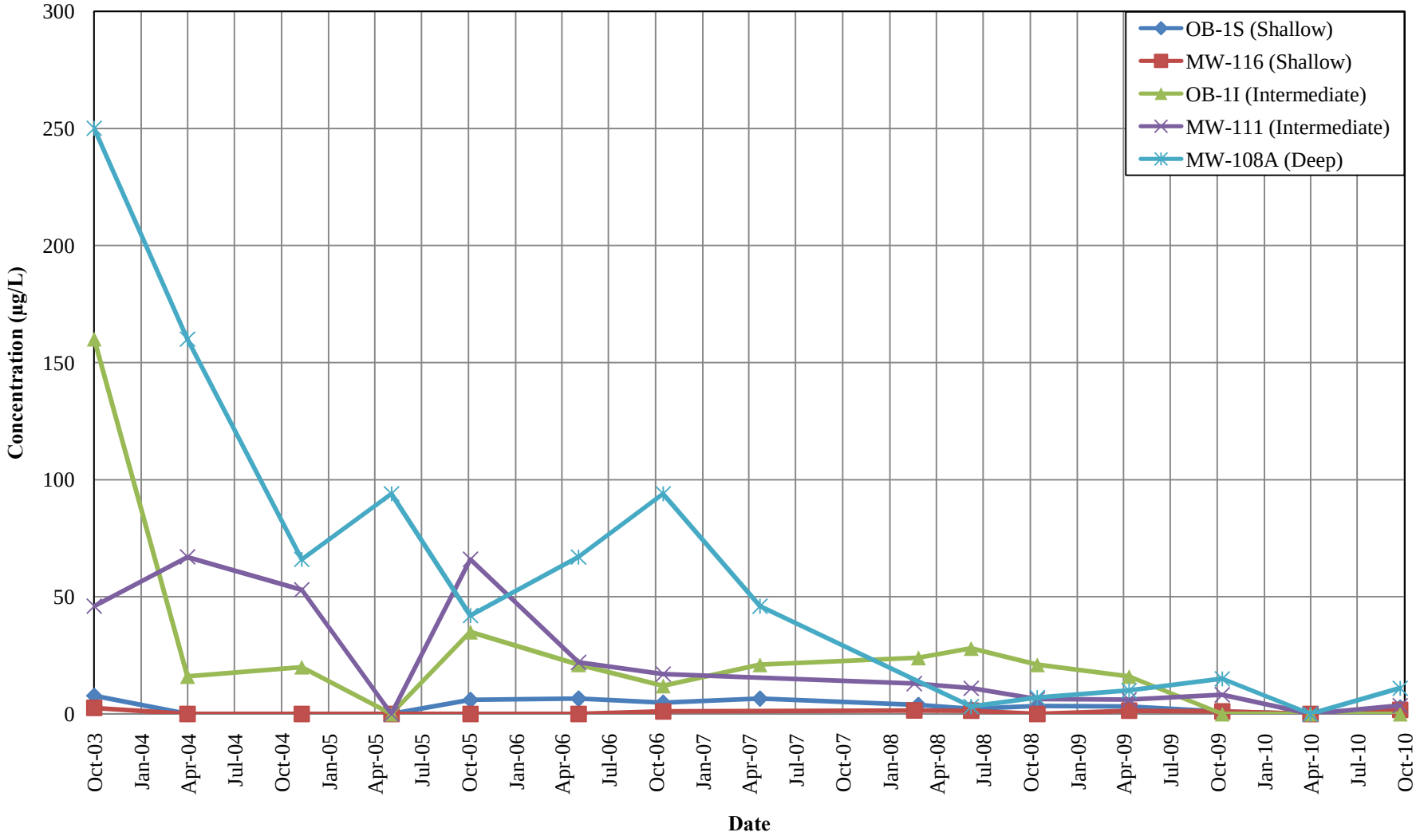


Figure 10

1,4-DIOXANE CONCENTRATION TRENDS
DOWN-GRADIENT WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

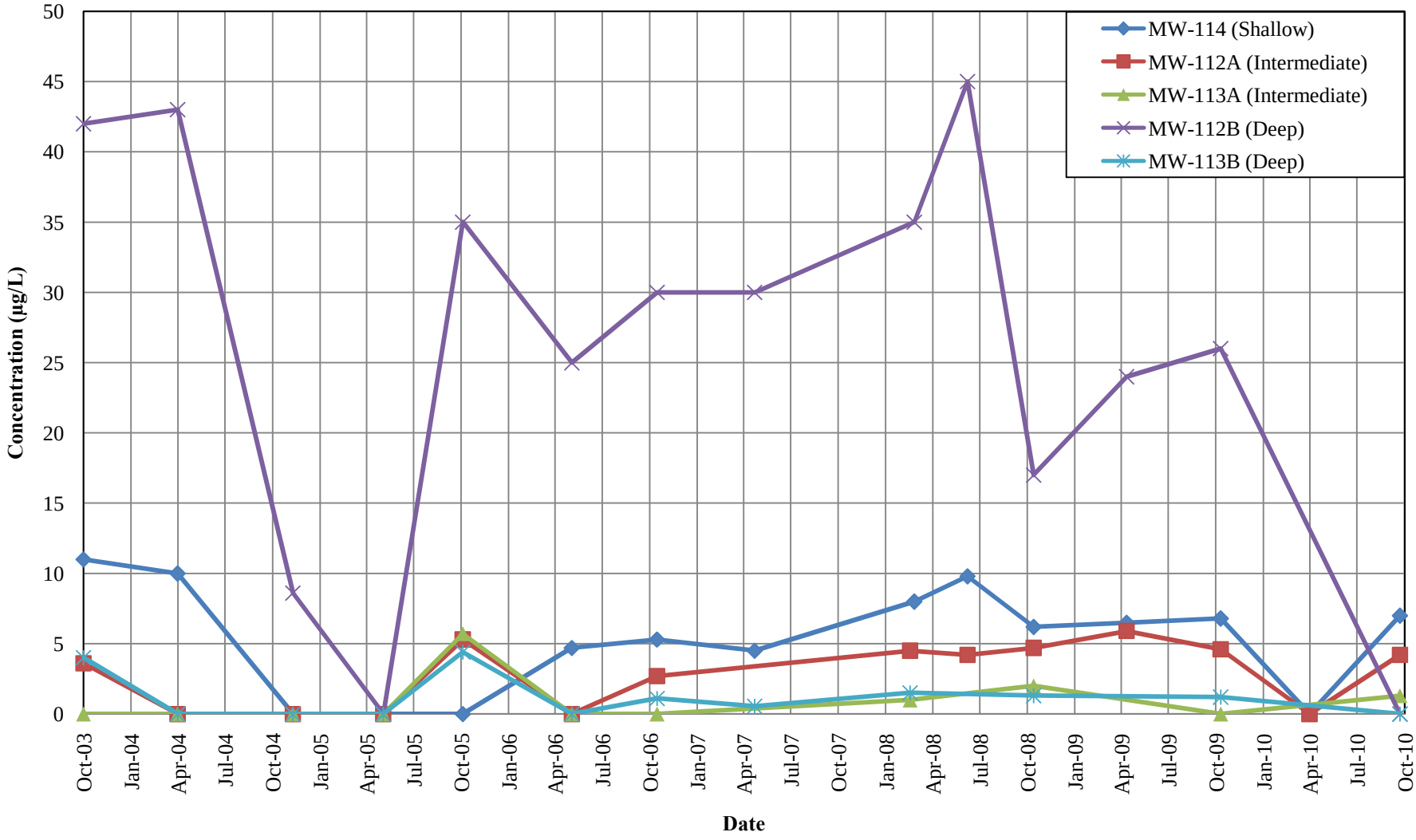


Figure 11

1,1-DCE CONCENTRATION TRENDS
EXTRACTION WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

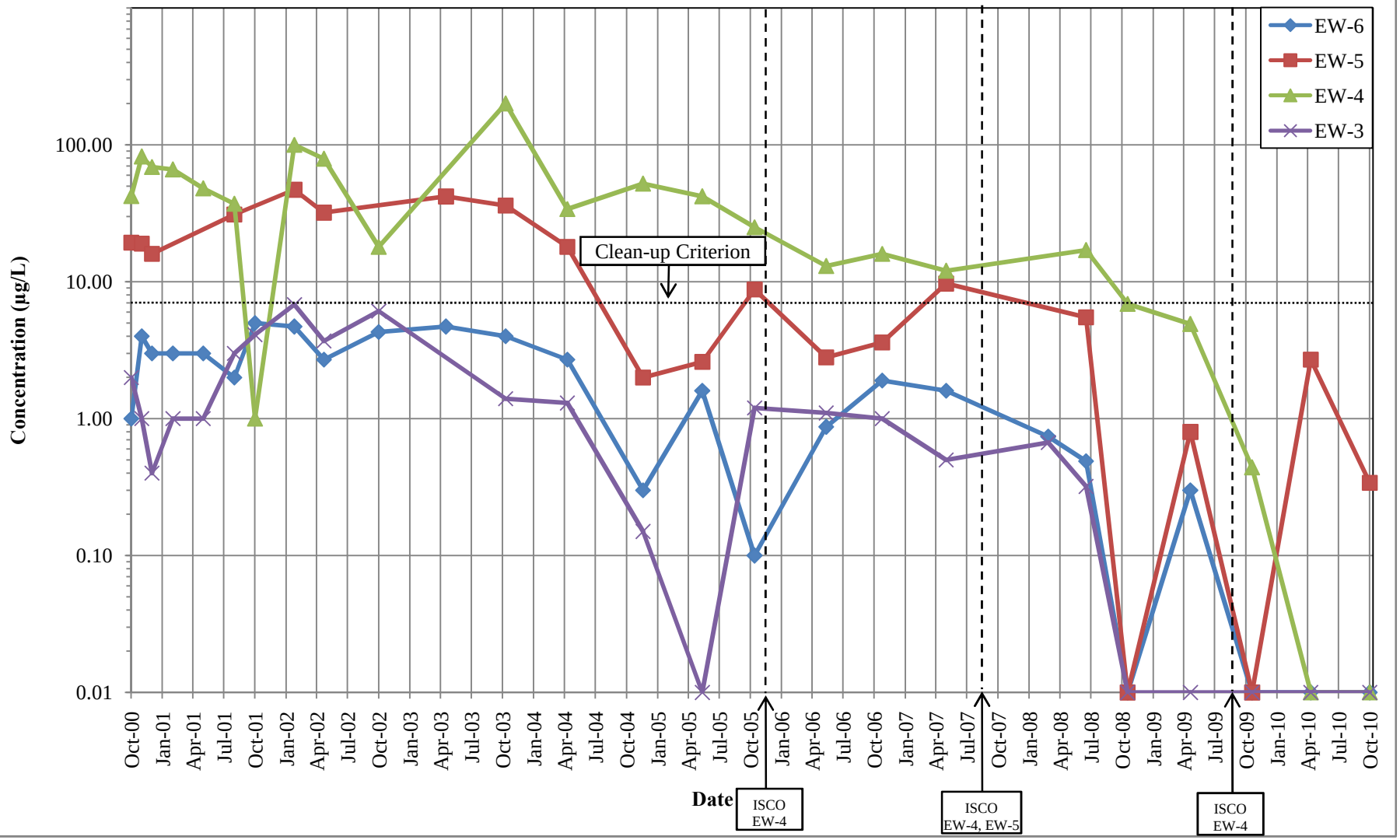


Figure 12

1,1-DCE CONCENTRATION TRENDS
SOURCE AREA WELLS
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

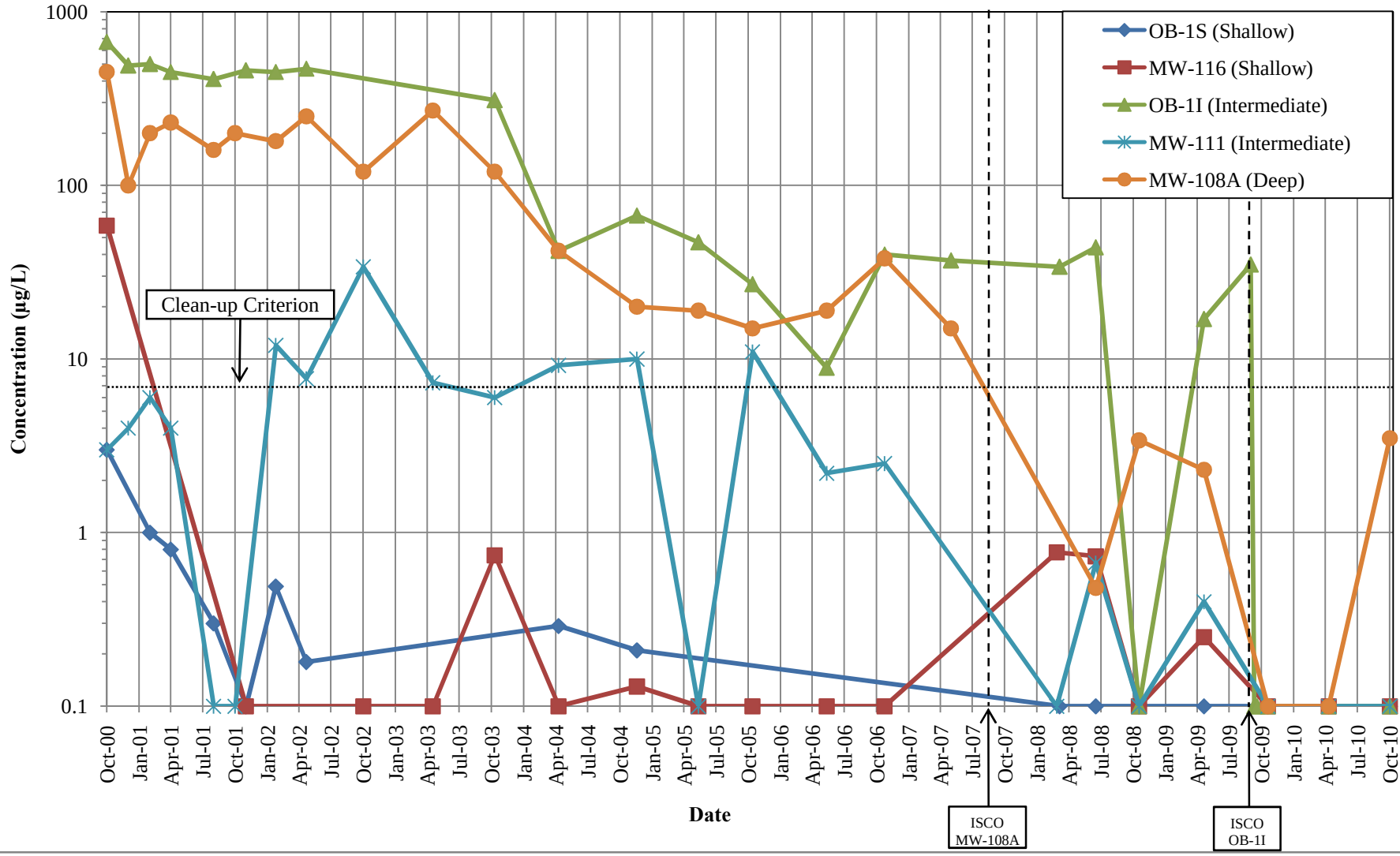


Figure 13

cis-1,2-DICHLOROETHENE CONCENTRATION TRENDS
OB-1I
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE

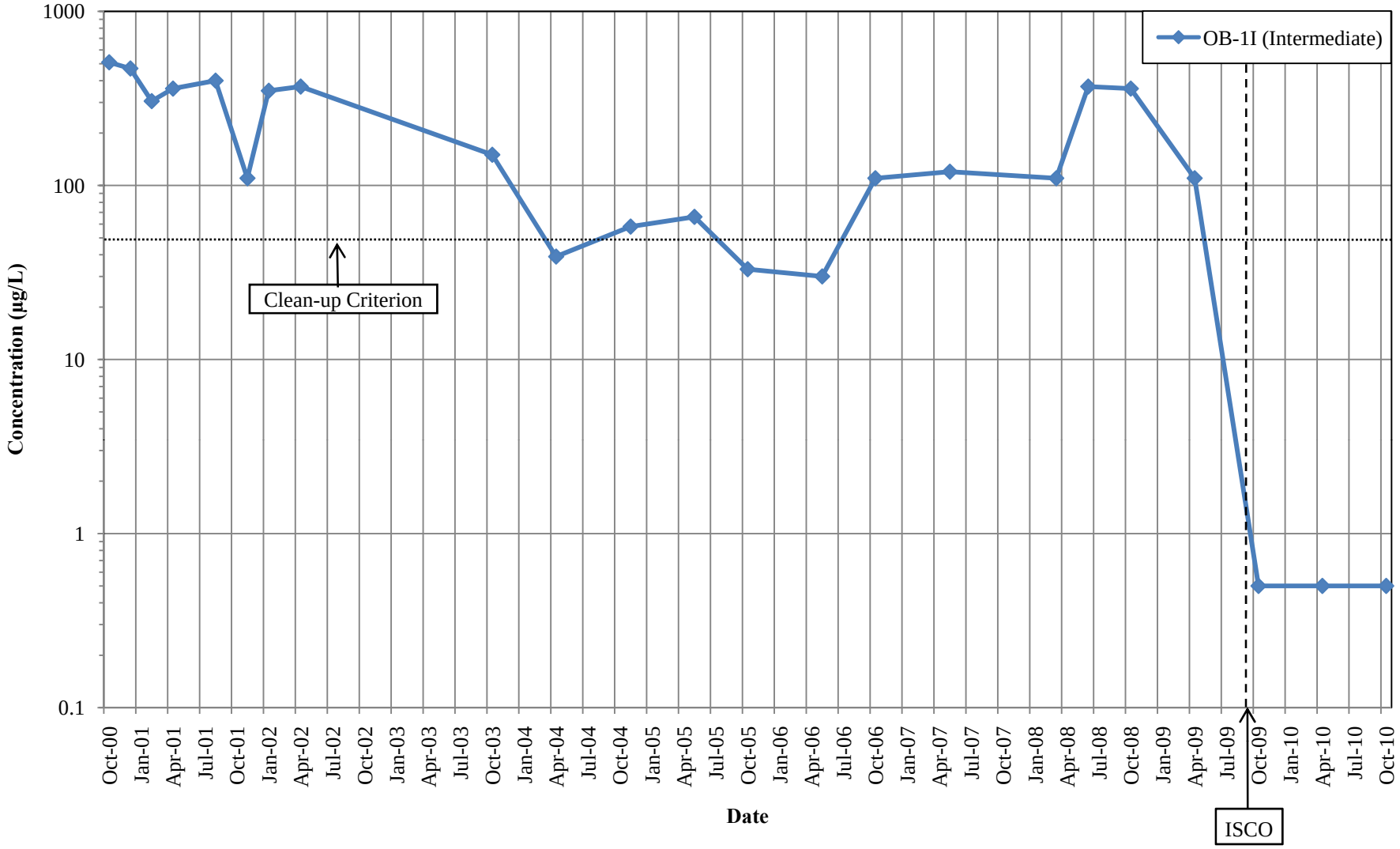
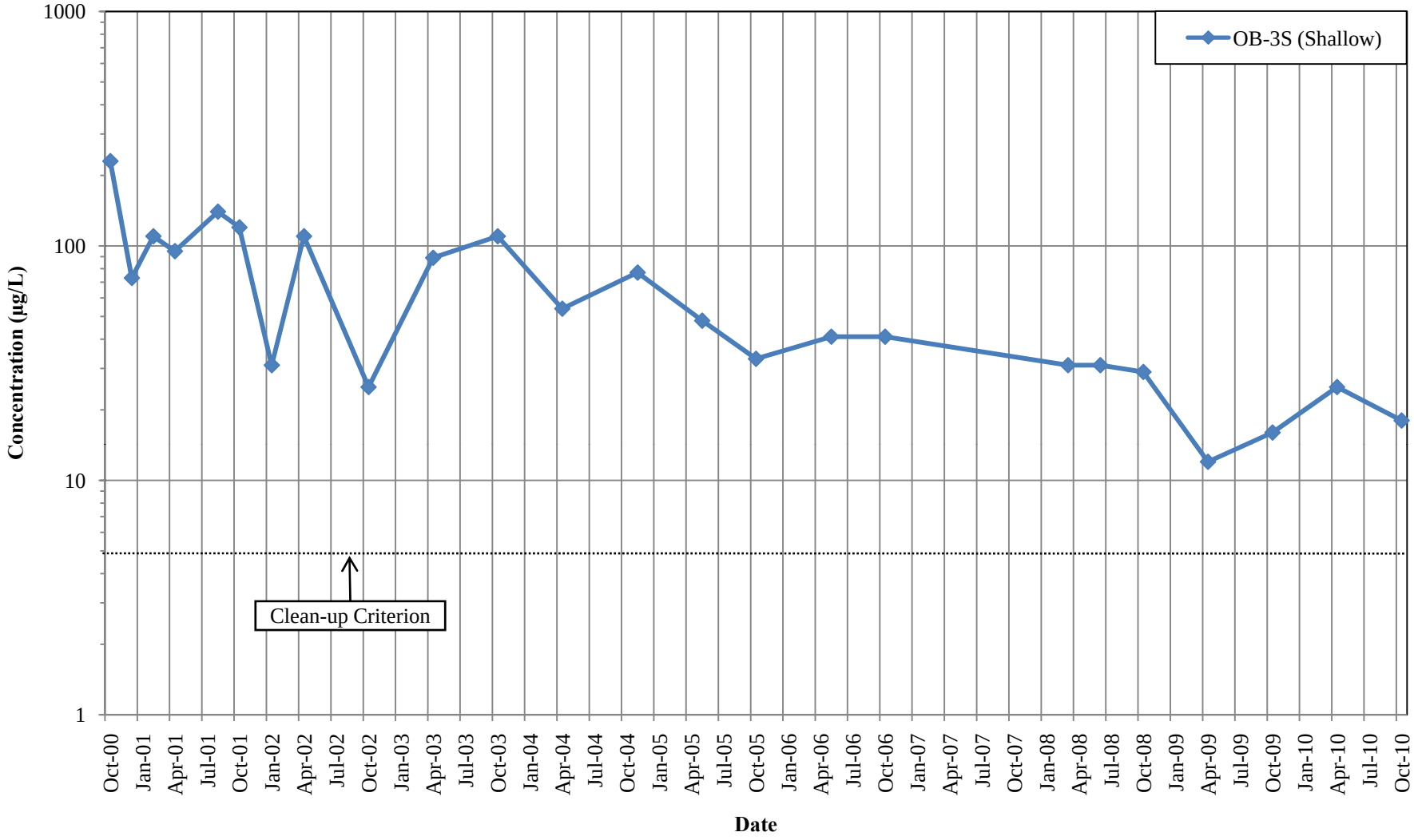
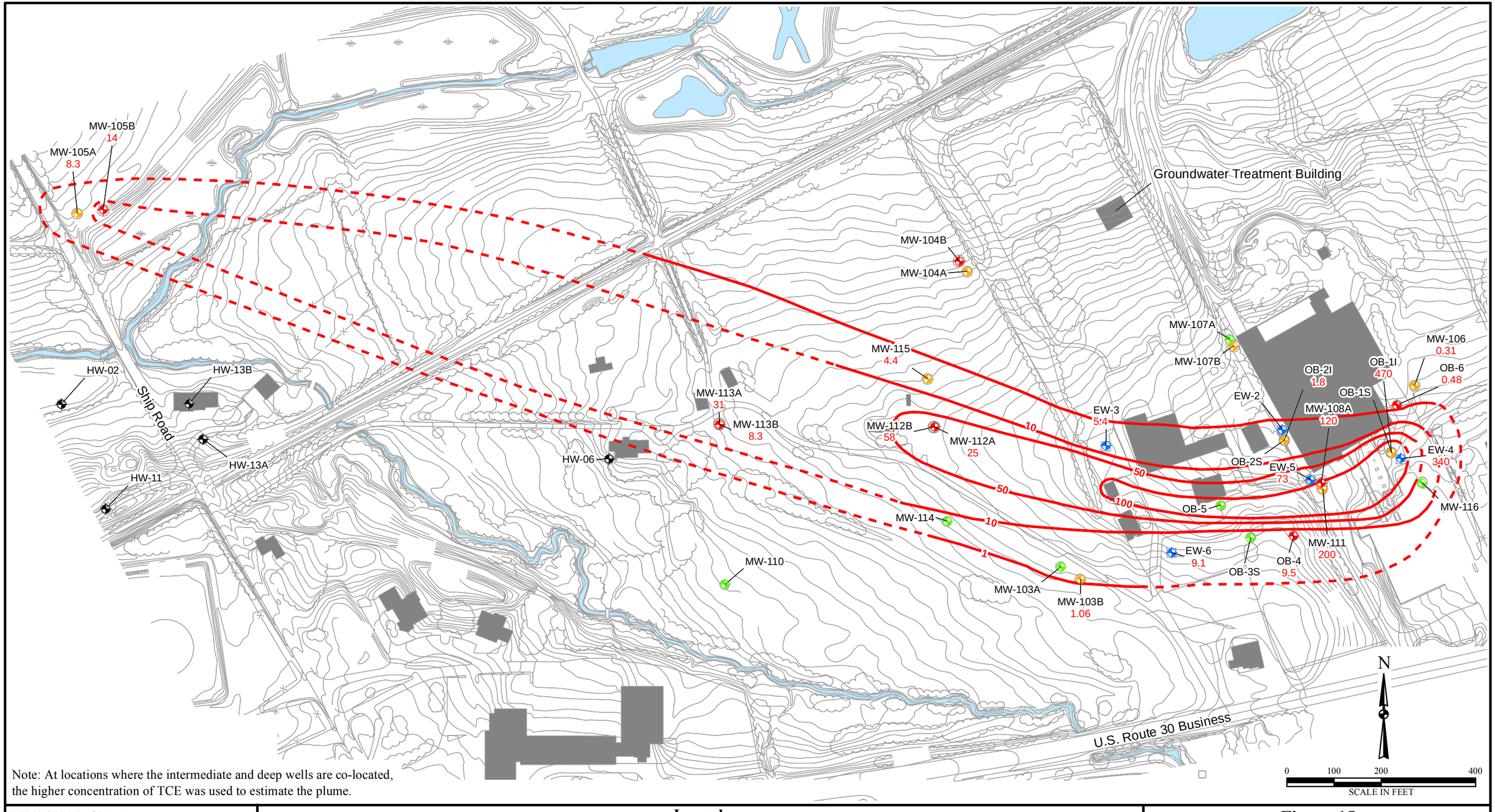


Figure 14

1,2-DICHLOROPROPANE CONCENTRATION TRENDS
OB-3S
OCTOBER 2000 - OCTOBER 2010
AIW FRANK/MID-COUNTY MUSTANG SITE





Note: At locations where the intermediate and deep wells are co-located, the higher concentration of TCE was used to estimate the plume.

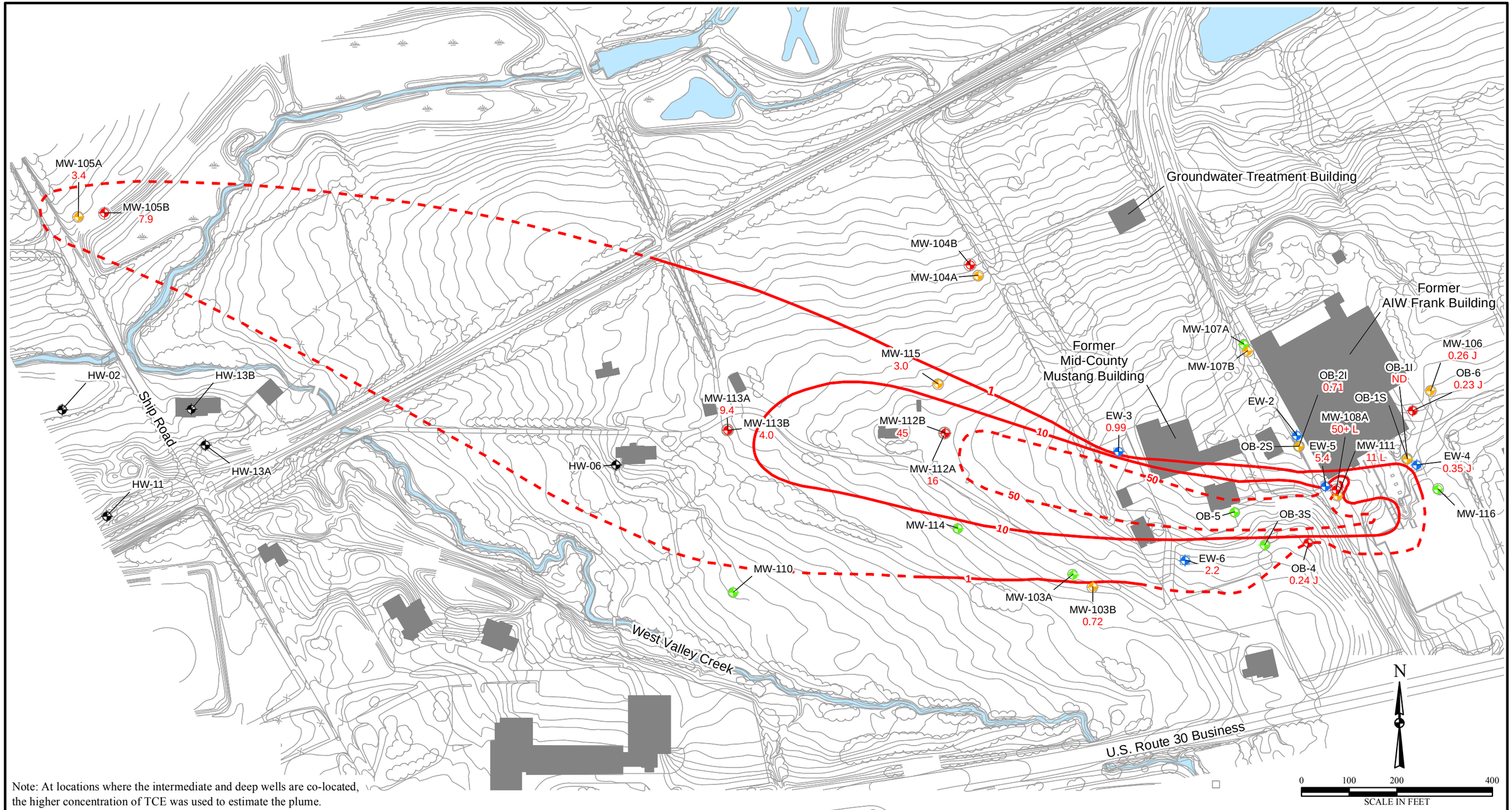
X:/EPA010/AIW_Frank/Maps/Oct_10_semianual_GW_Monitoring/TCE_Intermediate_Deep_Bedrock_Oct05.mxd
Source: HydroGeoLogic, Inc.
01/26/2011 CNL

HGL HydroGeoLogic, Inc

Legend

- Shallow
- Intermediate
- Deep
- Extraction
- Residential
- —1— TCE Concentration Contour (µg/L)
- – 10 – Estimated TCE Concentration Contour (µg/L)
- 1.7 TCE Concentration (µg/L)

Figure 15
TCE Concentrations for Intermediate and Deep Bedrock Wells October 2005
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania



Note: At locations where the intermediate and deep wells are co-located, the higher concentration of TCE was used to estimate the plume.

X:/EPA010/AIW_Frank/Maps/Oct_10_semianual_GW_Monitoring/TCE_Intermediate_Deep_Bedrock_Oct10.mxd
Source: HydroGeoLogic, Inc.
12/06/10 CNL

HGL HydroGeoLogic, Inc

Legend

- Shallow Well
- Intermediate Well
- Deep Well
- Extraction Well
- Residential Well

1 — TCE Concentration Contour (µg/L)

10 – – Estimated TCE Concentration Contour (µg/L)

J — Analyte Present (Reported value may not be accurate or precise)

L — Analyte Present (Reported value may be biased low)

ND — Not Detected

\+ — Positive result reported from diluted analyses

1.7 — TCE Concentration (µg/L)

Figure 16
TCE Concentrations for Intermediate and Deep Bedrock Wells October 2010
AIW Frank/Mid-County Mustang Site
Chester County, Pennsylvania